

# Compressed Air Magazine



**SEPTEMBER 1960**

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 BEARINGS AND AIR  
 HERITAGE OF A SHIPBUILDER  
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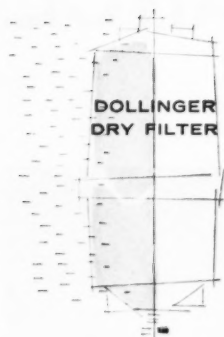


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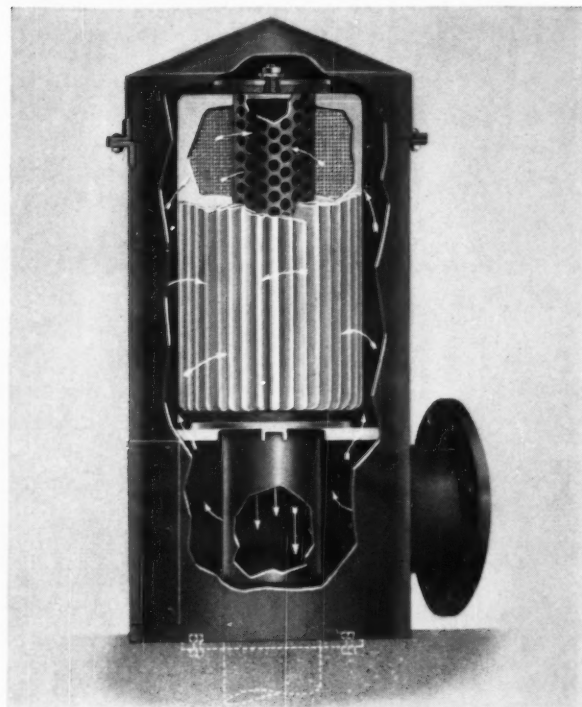


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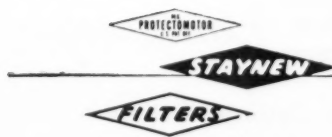
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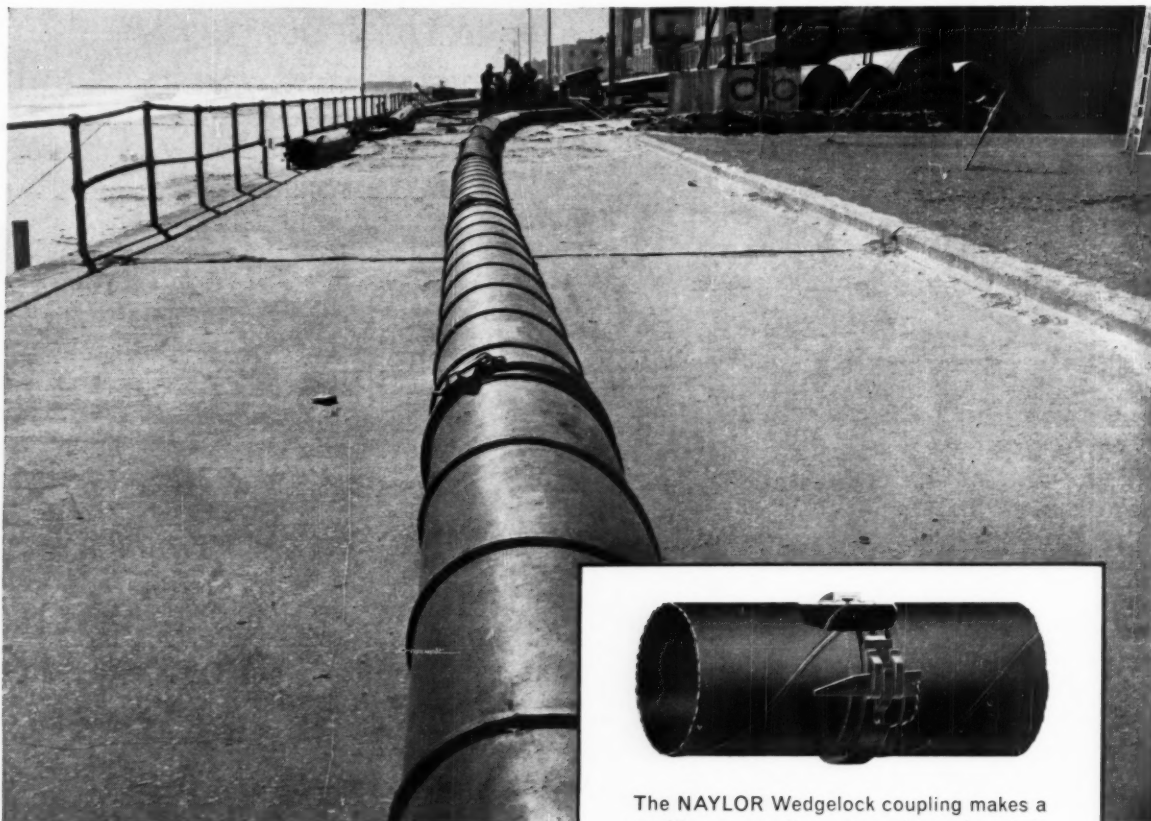


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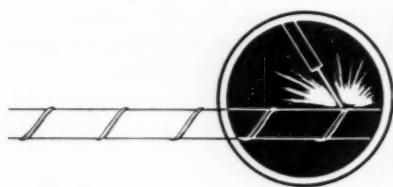
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# Compressed Air

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## on the cover

The railroad car suspended above the dock in our cover picture has just finished a long trip. Shortly it will take another. The ship has carried it to Port Cartier on the lonely north shore of the St. Lawrence River's diverging mouth. When nearly 200 miles of railroad have been put in, the car will travel north into the interior to Quebec Cartier Mining Company's iron ore field at Lac Jeannine. *Hewing an Iron Mine Out of the Wilderness* in this month's issue tells the story about laying bare the mine, whose ore will again and again be piled high into the car, and shipped down to vessels waiting at the port.

## 10 Hewing an Iron Mine out of the Wilderness— Eric LeBourdais

As steel mills begin to want concentrated ores, the iron fields of Canada's Labrador Trough move into a dawn of development. Quebec Cartier Mining Company is opening up a mine at its Lac Jeannine claims in a vast construction project.

## 15 Compressed Air Aids Bearing Manufacturer

Precision ball and roller bearings are turned out in quantity at a new plant in Indianapolis. Pneumatics is a major factor in the machining, gauging and assembly operations at the factory.

## 18 Newport News Shipbuilding and Dry Dock Company: Part I, The Yard and Its Heritage—S. M. Parkhill

Besides a tradition of building good ships, this company has acquired a complex physical plant during its 74 years of operation. The first of two articles about the concern.

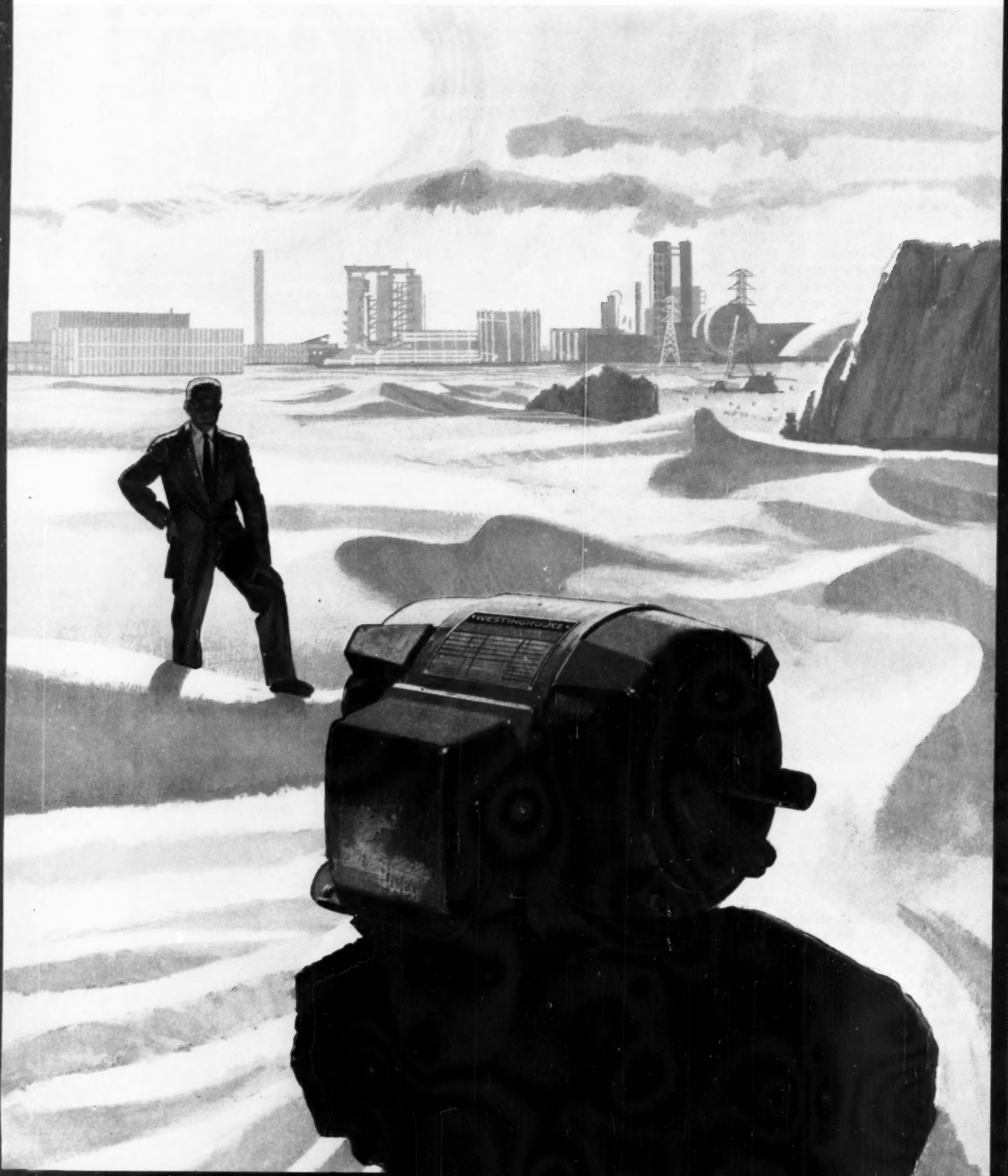
## 28 Fluid Energy Grinding

Grinding titanium dioxide at New Jersey Zinc forms a rare case history about the use of Micronizers.

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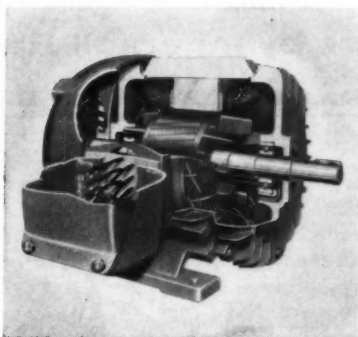
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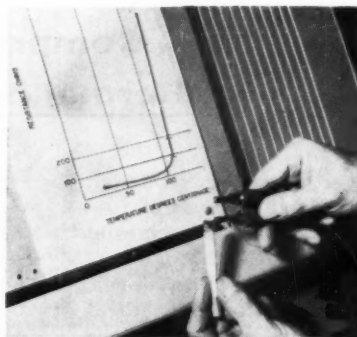
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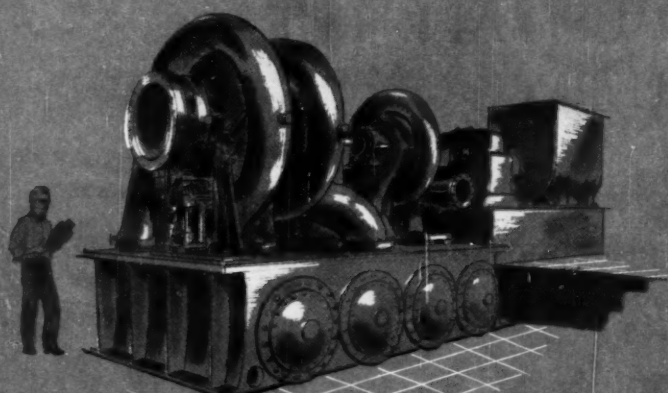
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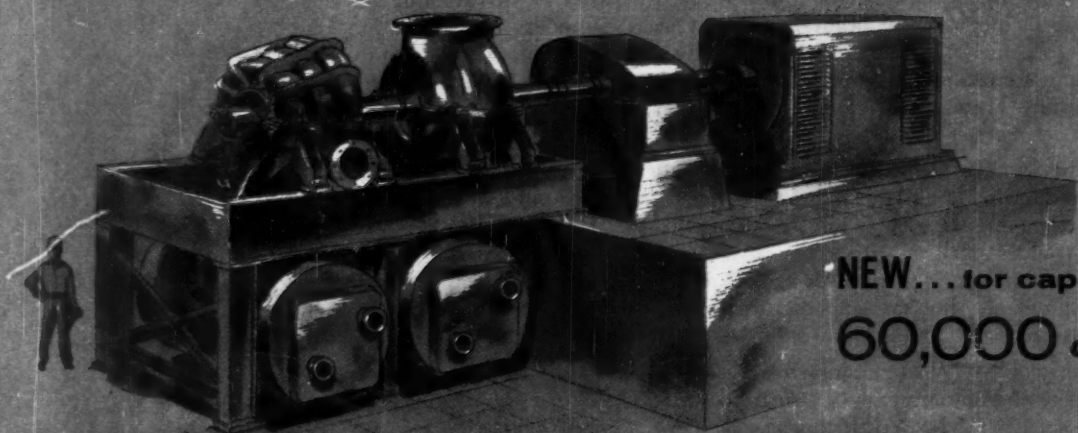
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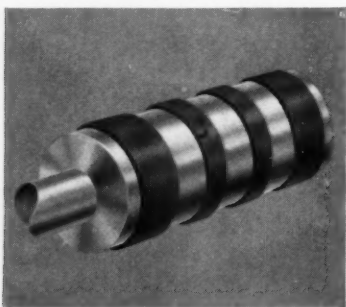
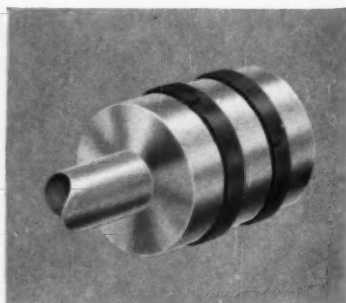
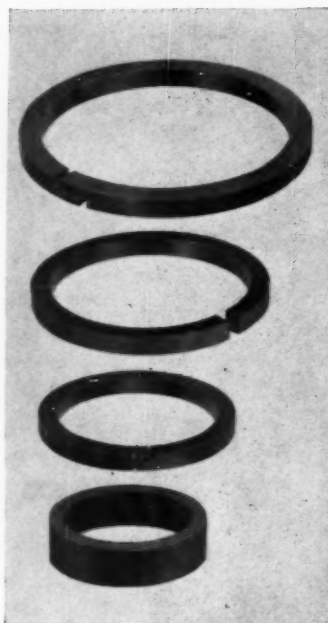
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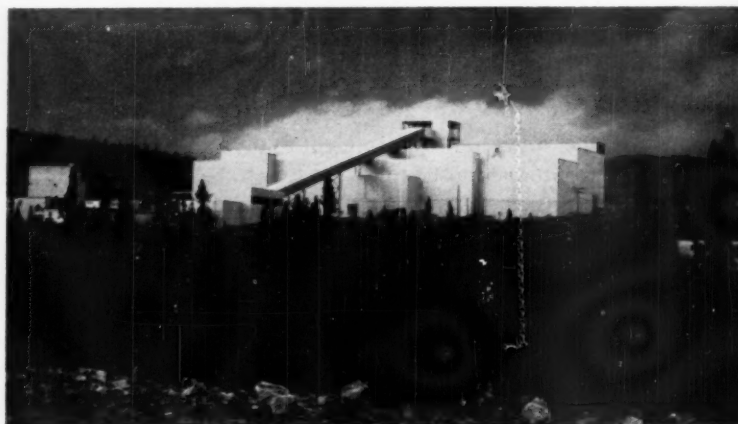
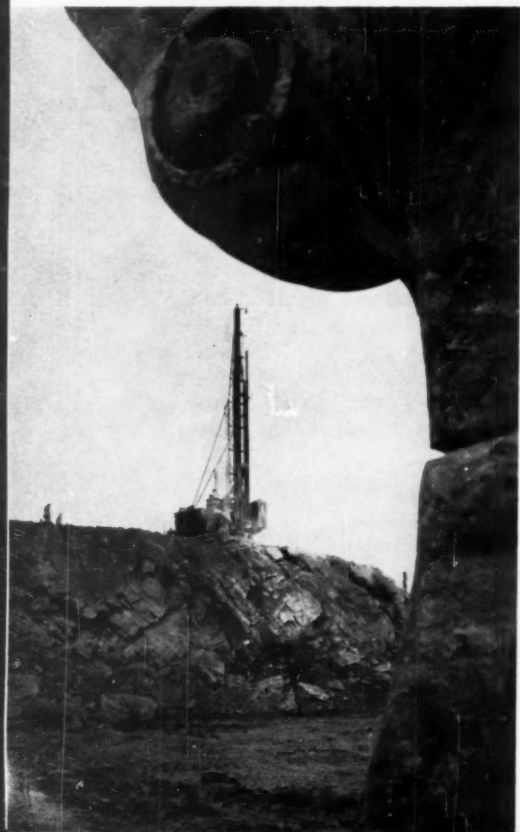
editor's note

## For the Steel Industry, A Changing Scene

*THERE is change today in the complexion of U. S. steel production. It is being felt in Canada, in all the Americas, in Europe, in Asia—indeed throughout the entire Free World. It springs from this: for three-quarters of a century some 80 percent of the iron ore consumed in the U. S. came from a few square miles of mine area in Minnesota and neighboring Michigan and Wisconsin. Now, the raw rich ores there are running out. Steel companies are looking to, and buying highly concentrated ores from, Canada, South America, Africa, and India. This year it has been estimated that about 34 percent of U. S. ore consumption will come from these countries.*

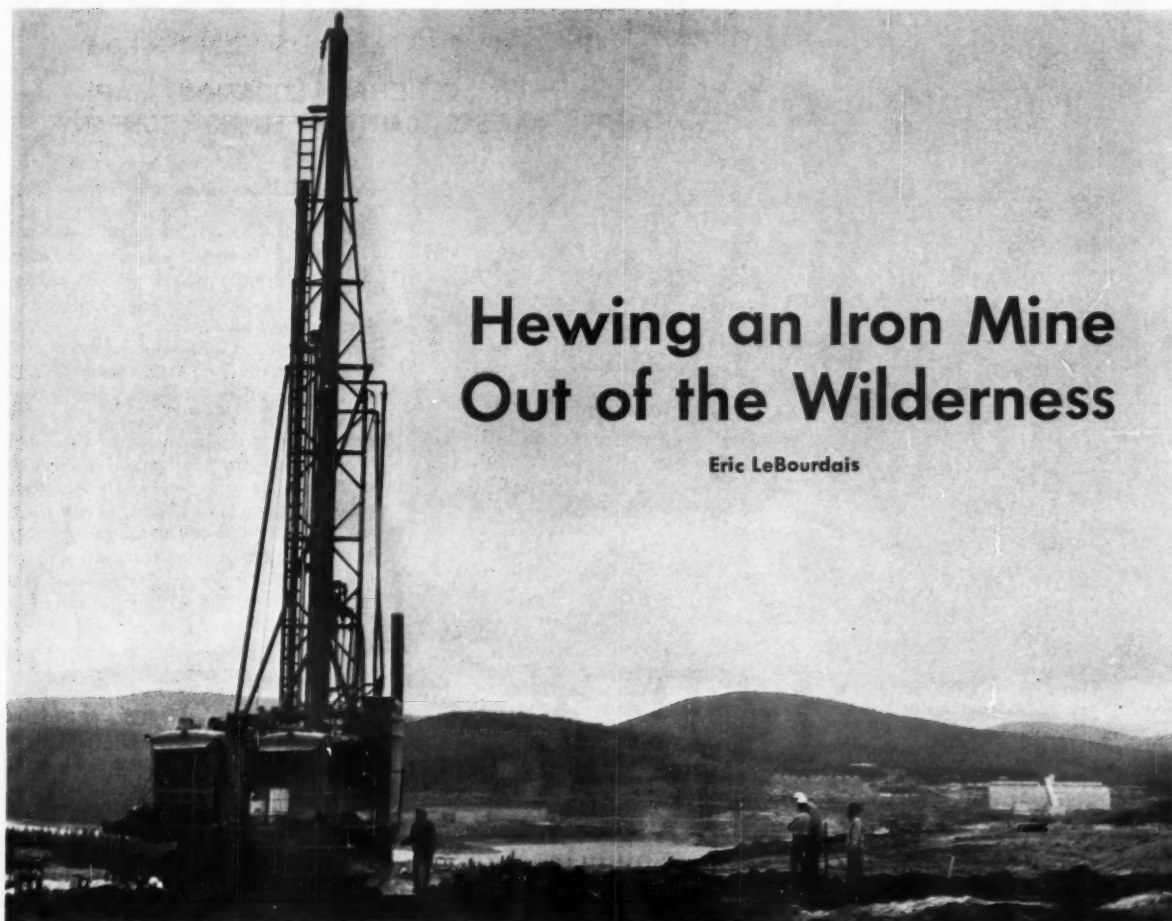
*The vast ore fields in what is called the Labrador Trough, in rugged eastern Quebec and Labrador, have an advantage over other ore-producing areas: potential accessibility. To the north is Ungava Bay. A few hundred miles to the south lies the St. Lawrence River.*

*Some ore carriers slip through the Seaway and others sail east out into the Atlantic and run down the coast, either directly to the steel mills, or to rail lines leading to the mills. The Iron Ore Company of Canada opened up the Labrador Trough in 1954 and the boom began. Today the Quebec Cartier Mining Company, a subsidiary of U. S. Steel, is getting ready to take ore from its claims there. Three major construction tasks are involved. One, the mine deposits must be laid bare, and the ore concentrating facilities, an electric powerhouse, and an inland town must be built. Two, 193 miles of railroad must be laid, including seventeen bridges and five tunnels. Three, a port must be chiseled out of the rock on the St. Lawrence River's north shore and a port town built. Lumped into one, these major jobs have been called the biggest and most costly venture in North America. This article tells about opening the mine at Lac Jeannine.*



Beneficiating plants like this one plunked down by Quebec Cartier Mining Company in the wilds near its Lac Jeannine iron fields are the new look in preparing ore for the steel mills. When this plant starts up late this year, it will be the world's largest.

Before iron ore can be mined, overburden and waste rock must be stripped away. At Quebec Cartier Mining's iron fields near Lac Jeannine, a large rig drilling blast holes is framed by part of a shovel.



## Hewing an Iron Mine Out of the Wilderness

Eric LeBourdais

**A heavy-duty blast-hole drill works at a site overlooking a tip of Lac Jeannine and Quebec Cartier Mining's large beneficiating plant, the whitish building at far right. Only aircraft and a primitive road currently connect the lonely site with civilization.**

**N**OT LONG ago the remote eastern section of Quebec, Canada's *Belle Province*, was known for its rugged scenery, a few paper pulp towns, and little more. Today the area bustles with activity. The reason is iron ore—millions of tons of it lying in the Labrador Trough, a long north-south geological belt, extending from the subarctic Ungava Peninsula down to Lac Jeannine. "Red gold" was first wrenched from the Trough in 1954 by the Iron Ore Company of Canada with its development at a town called Schefferville. Prosperity came both to the inland town and to the Canadian company's port called Seven Islands, on the north shore of the St. Lawrence river. The town's population jumped from 2000 to 10,000 in just a few years.

Today's mushrooming activity centers around Port Cartier, about 45 miles west of Seven Islands, where Quebec Cartier Mining Company will load its ore to vessels and where the company's headquarters are located. When in January 1961 the first ton of ore is concen-

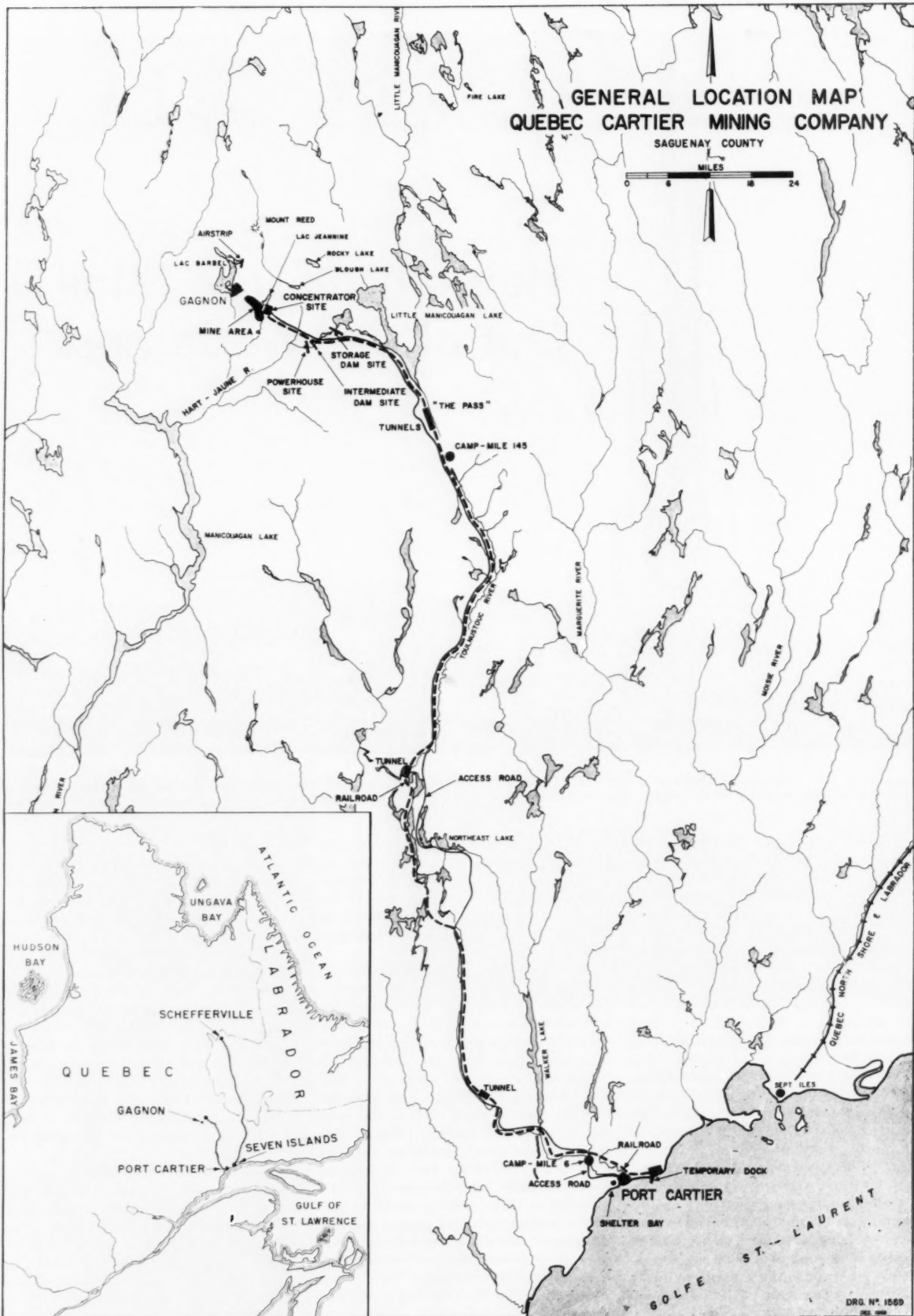
trated, railroaded to Port Cartier and put on an ore carrier, that ton will carry a \$200 million price tag. Although much of the ore will be shipped to the U. S., Quebec Cartier will also market its product to Canadian and European steel mills.

Man's mark has scarcely been felt before in this part of North America. Norsemen are known to have visited the Labrador coast as early as the tenth century and possibly much earlier; the coast even may have been the first part of North America seen by white men. But it is unlikely that white men tramped into the interior until early in the nineteenth century. Several Hudson Bay trading posts were established there in the 1800's, including Fort Nescauppee, about 15 miles from Schefferville, itself founded in 1840. During the latter part of the century many fur traders and missionaries traveled the area though they left little record of their wanderings. One interesting exception was Father Pierre Babel of the Oblate Fathers who drew a map depicting the upper waters

of the Hamilton River and mentioned "abundant iron." One of Canada's most distinguished scientists and explorers, Dr. A. P. Low, strode into the interior during the years 1892-94. Although he did not discover usable ore, he saw many iron formations and recommended that the area be thoroughly prospected.

During the next 50 years exploration was only intermittent for the interior was thought to be too inaccessible for its ore potential. Not until after the Second World War did serious exploration begin. A glance at a claims map of the region today shows that more than 40 companies have mining interests, though as yet only a handful are preparing for development.

In 1952 the Cartier Mining Company Limited started intensive investigation in the southwestern section of the Labrador Trough in Saguenay County. In 1957, a descendant firm, Quebec Cartier Mining Company, was incorporated. Its purpose was to explore and develop the deposits of low-grade iron ore, which research had indicated could be converted

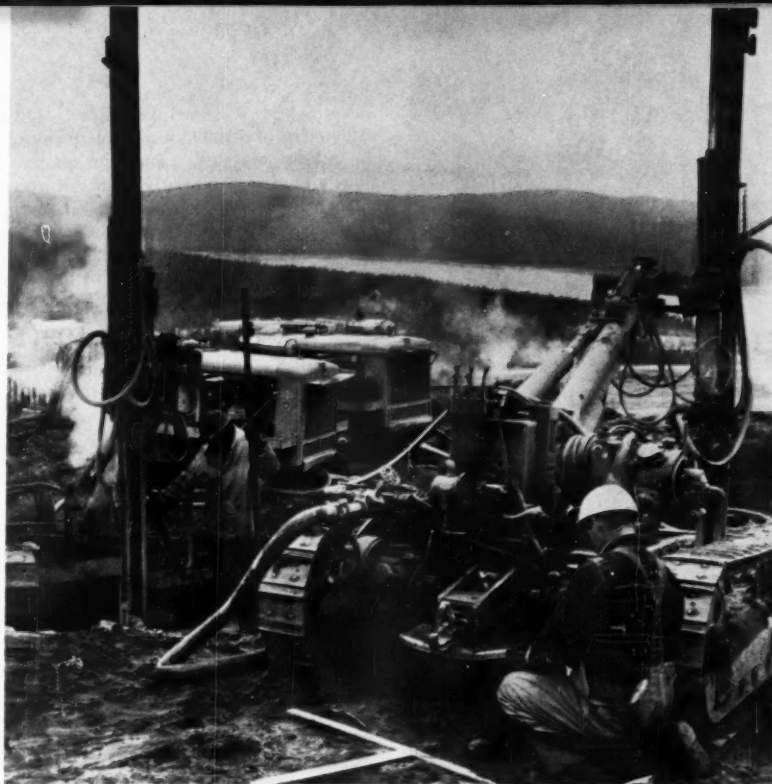


at the site into a commercially usable iron concentrate.

The concern's ore deposits center around Lac Jeannine and cover an area about 8000 feet long, varying in width from 600 to 2300 feet. More than 200 million tons of ore lie there, waiting to be fed to the steel mills. In its later stages the mine will be an unusually deep open pit, as excavation reaches an expected 1000-foot depth. The company also has extensive holdings farther north which can be developed when the Lac Jeannine deposits run low.

Specifically, the iron at Lac Jeannine is a specular hematite, a silica mixture that adapts well to gravity separation, permitting economic beneficiating at the site. It is estimated that a day's production will run approximately 60,000 tons of ore, or 1500 giant truck loads of rock daily on a year-round production basis. This would mean a total annual production of some 20,000,000 tons of ore. With a designed capacity of over 8,000,000 tons of ore concentrates annually, the concentrator being built at the site will be the largest iron ore beneficiating plant in the world. A 4000-5000 person town named Gagnon (after Onesime Gagnon, Quebec's first Minister of Mines and current Lieutenant Governor) is being constructed about 8 miles from the concentrator site to house workers and their families. (A total of 2000 workers normally will be employed at the Lac Jeannine and Port Cartier facilities.)

Before the miners reach the ore, however, up to 50 feet of overburden and



**CRAWLERS** Dust flies as crawler units drill holes to establish a bench where larger drill rigs will work. Two 600-cfm portable compressors provide air. About 50 feet of overburden and rock—12,000,000 yards total—must be stripped. Beyond the compressors can be seen Lac Jeannine's waters.

**MINE SITE** Taken from the concentrator building, this view shows the mine in the distance. At right is a lightcolored strip—a haul road between the two.





waste rock must be stripped away. This will consist of a 100-foot-wide strip round the whole orebody. Such an excavation—about 3,000,000 cubic yards of overburden and about 9,000,000 cubic yards of waste rock—usually would be a major undertaking in its own right. But viewed within the perspective of the work to come, the stripping is only a troublesome nuisance. It is troublesome because the waste rock is largely tough dolomitic marble, quartz and gneiss. Ore benches are designed at 40-foot intervals and drill depths allow for 5 feet of subdrilling. Initially there will be three separate pits and by the time production starts, some 11,000 lineal feet of 40-foot ore benches will be ready for extraction.

### Mucking Equipment

A fleet of 8-yard electric shovels is handling the bulk of the mucking. All 36 hauling units at the mine are 40-ton rear-dumps and nine Cat D-8 bulldozers are being used for shovel clean-up and clearing. The company has been experimenting with rubber-tired tractors for clean-up work because of their fast road speed. During the present wasting operation hauls are fairly short, but when production mining starts soon, the trucks will have to drive from 2000 to 10,000 feet to the crushers at the south end of the lake. The company's policy for developing ore contacts has stressed that there be a minimum of ore handling. Ore that is encountered is stockpiled.

This summer saw peak activity at the mine and along the entire development as up to 7500 men were at work. Since excavation began in June 1959, about 3,000,000 cubic yards of material has been removed. Production has gradually increased during that time as the heavy equipment arrived at the site. When the initial 60,000 hp was available late this summer from the eventual-175,000-hp Hart-Jaune River Power Development, the mine was able to step up its use of available electric shovels and drills. The powerhouse is being built for an affiliate firm, the Hart-Jaune Power Company, with the Foundation Company of Canada as contractor. Previously the machines had been powered by a temporary generating station at the mine.

Completion date for the entire ore development program is set for December of this year. The problems facing the company at the mine have had two main origins: the remoteness of the

site and the extreme winter weather, which often resembles arctic conditions. An access road, winding for about 200 miles through the topsy-turvy terrain north of Port Cartier, is the supply route for practically everything on the job. Perini-O'Connell-Quemont built the road prior to the start of the mine's development. While not recommended for car travel, the route nevertheless has provided access by truck and enabled Quebec Cartier Mining to set its present tight construction schedule. It is interesting to note that at the moment no road joins the north shore region along the St. Lawrence with the rest of Quebec province. One is being built, but until completed, all materials will continue to come in by ship and be transferred to trucks.

An airstrip for the mine has been built at neighboring Lac Barbel (site of Gagnon) but economics dictate the use of trucks for most cargos. The rough, gravel road is hazardous at the best of times, and to make sure that the trucks get through, convoys travel with pilot vehicles at each end. The 200-mile trek has been made every day since work began, sometimes with more than 100 transports loaded with up to 50 tons of cargo.

### Second Enemy

The weather—the second major cause of problems—sent temperatures as low as  $-60^{\circ}$  F during the winter. Strange things happen to both men and machines at this temperature. Steel becomes brittle, arctic lubricants turn to jelly. Men often stop working and if they don't, then their machines often fail. When ordering equipment, Quebec Cartier Mining has specified its own designs whenever possible, including such items as dump truck bodies and shovel stocks, utilizing U. S. Steel's low-temperature resistant T-1 steel. All truck engines have been built with electric hot water circulating heaters; strip heaters on electric motors keep them hot between shifts. To eliminate battery troubles at low temperatures, all of the ore trucks were designed with air starting motors.

At the mine the extreme cold caused an unusual problem. Slurry-type explosives, packed in plastic bags, tended to become oval in shape when stored in their containers. The cold solidified the material, making placement of the charges down the holes impossible. As a solution, the supplier for all the mine's explosives, shipped its ammonium nitrate-TNT-water mixture in cylindrical containers. Blasting at the mine, of course, is a major operation: 30,000-cubic-yard shots are set off daily and some blasts have run as high as 92,000 cubic yards.

**TALK** At left, tall John Siverson, a supplier's representative, discusses a point with Quebec Cartier's chief mine engineer, Robert Temps. In the foreground are ammonium nitrate cylinders. A heavy-duty rig drills in the background.

# Compressed Air Aids Bearing Manufacturer

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**M**AKING precision ball and roller bearings in a highly automated plant calls for some intricate equipment and planning if quality is not to be sacrificed for the high speed, increased capacity and lower costs of automatized work. Link-Belt Company's new plant in Indianapolis, Ind., is a unique manufacturing facility. Electronically controlled machine tools automatically maintain tolerances as close as 0.0000028 inch. Yet, as many as 758 gauging operations are performed on a single bearing—one of the firm's new high-precision spherical roller type—before it can be packed for shipment. Link-Belt, of course, is one of the world's largest builders of specialized materials handling equipment, and the Indianapolis plant has been made a showplace with a variety of carefully designed and engineered Link-Belt materials-handling conveyors.

Compressed air is "both brawn and brains" to the new plant, according to company engineers. It pushes, pulls and clamps in a variety of ways. It powers portable pneumatic tools. It's also used in air gauges to assure proper concentricity and shape as well as size. On proper signals from a bank of instruments, air lines, working like motor nerves and muscles, do such tasks as furnishing the proper number of correct size balls to a ball-bearing assembly fixture.

Link-Belt's new plant has 50 percent greater capacity than the facility that it replaces and in which the company began manufacture of bearings in Indianapolis a quarter century ago. It is a complete unit devoted to engineering, research and development, sales and manufacturing. It is located on a 70-acre portion of a 140-acre site (thus providing ample area for future expansion) and has a floor area of 454,000 square feet. Of this, 400,000 square feet is taken up by a 1-story manufacturing structure. The remainder of the area is reserved for offices in a 2-story structure with full basement.

The end products of the new plant are ball and roller bearings including self-aligning types, the firm's new ultra-precision spherical roller bearing and

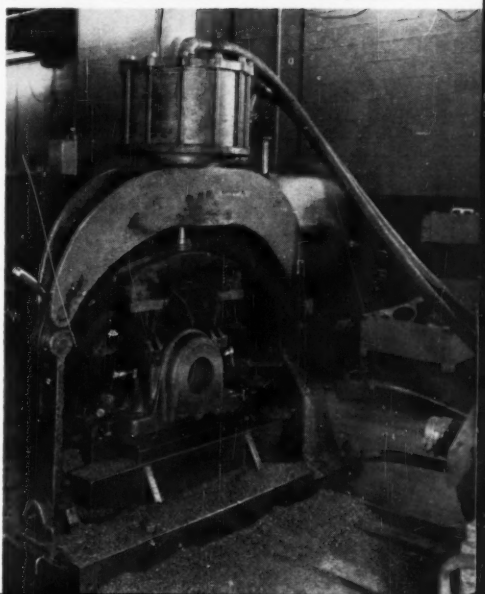
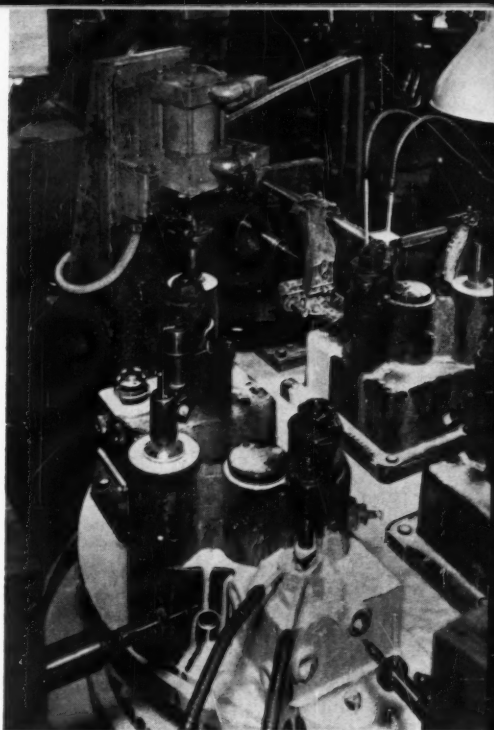
other self-aligning ball and roller bearing transmission units.

Link-Belt engineers designed the plant. Its operation can be summarized simply as follows: steel progresses from the raw tube or bar through the initial machining departments into heat treating and precision grinding to final inspection. Inspected parts are transferred to storage. In subsequent steps, these are subassembled into unmounted ball and roller bearings and placed in first-in, first-out storage for final assembly. Cast housings, received at the opposite end of the plant, are painted and progress through machining and inspection to stores, ready for final assembly with component subassemblies.

Seven overhead trolley conveyors, an in-the-floor Trukveyor (which tows 4-wheeled industrial trucks) and a series of powered and gravity roller conveyors keep parts moving through the various stages of manufacturing. Compressed air works on these lines to transfer parts baskets and to route finished parts to the correct storage areas (see pictures on page 16).

In the initial machining stages, both of housing and bearing parts, compressed air cylinders clamp and hold parts during machining. Portable pneumatic tools are used to speed loading and unloading of mechanical clamping jigs. Little difficulty is experienced in maintaining tolerances on early-stage machining operations for these are relatively generous in comparison to those that must be maintained in finish grinding. It is in this finishing phase that Link-Belt's electronically controlled machine tools show their worth. In the previously used method of grinding raceways, for example, a series of manually controlled cuts was made, each followed

**MACHINING** Air-actuated cylinders are utilized to clamp many parts during machining operations. The picture at the top shows the set-up for an operation on bearing parts. The one at the bottom shows one for bearing housings. In the center picture, an Ingersoll-Rand size 518 Impactool is being used for tightening clamps on a continuous rotary milling machine.



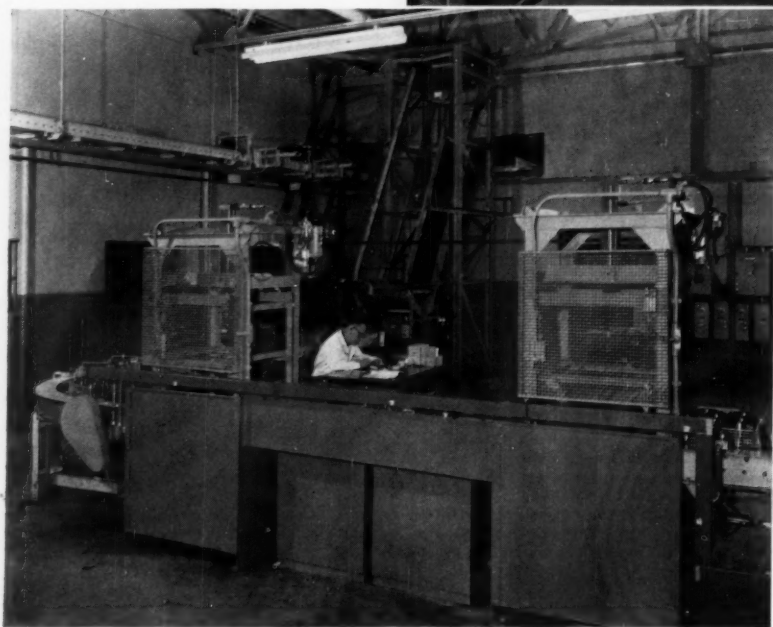
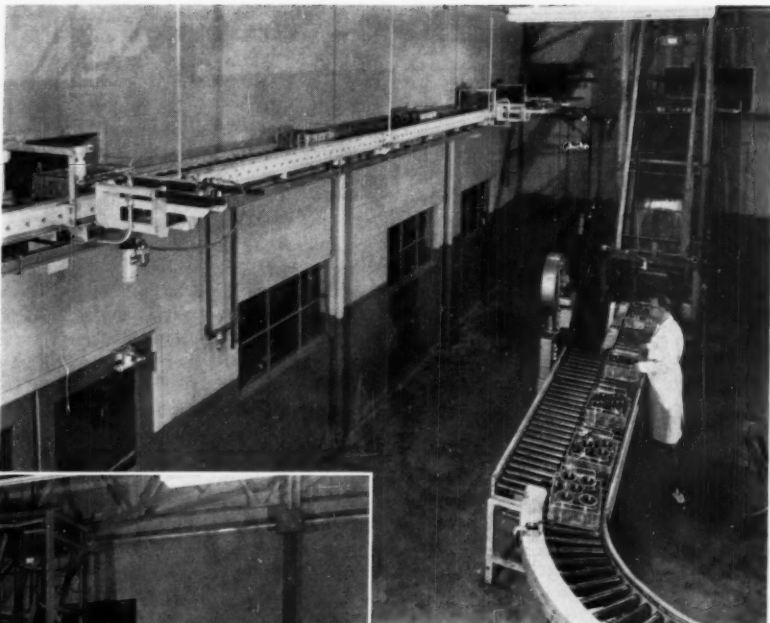
by a manual gauging operation until the required size was reached. When tolerances were exceeded, waste was high. With the automatic centerless grinding tools, in-cycle gauging is incorporated into the machine controls to avoid over grinding. These machines are also automatically fed and the grinding wheels automatically dressed to compensate for wheel wear.

Despite the precautions taken during machining, however, additional gauging checks are made following every operation and these are repeated prior to final assembly. A spherical roller bearing with 42 rollers actually receives a total of 758 separate gauging checks before it is deemed suitable to ship.

Prior to the finish grinding of parts, they are heat-treated in controlled atmosphere furnaces followed by quenching and then deep freezing at a temperature of  $-120^{\circ}$  F to insure dimensional stability and to permit their use under severe heat applications. Following grinding the bearing components are ultrasonically cleaned to remove all traces of foreign material (even fingerprints), and are then inspected.

Inspection and assembly rooms are air-conditioned and dehumidified to maintain controlled conditions under which all components will have a common dimensional relationship. In addition, storage for finished parts is under humidity and temperature control.

Following the final inspection of components, they are loaded into baskets and placed on live roll conveyors on their way to subassembly steps. Each basket is dipped by an air cylinder into a tank of a fingerprint neutralizer and light rust preventive.



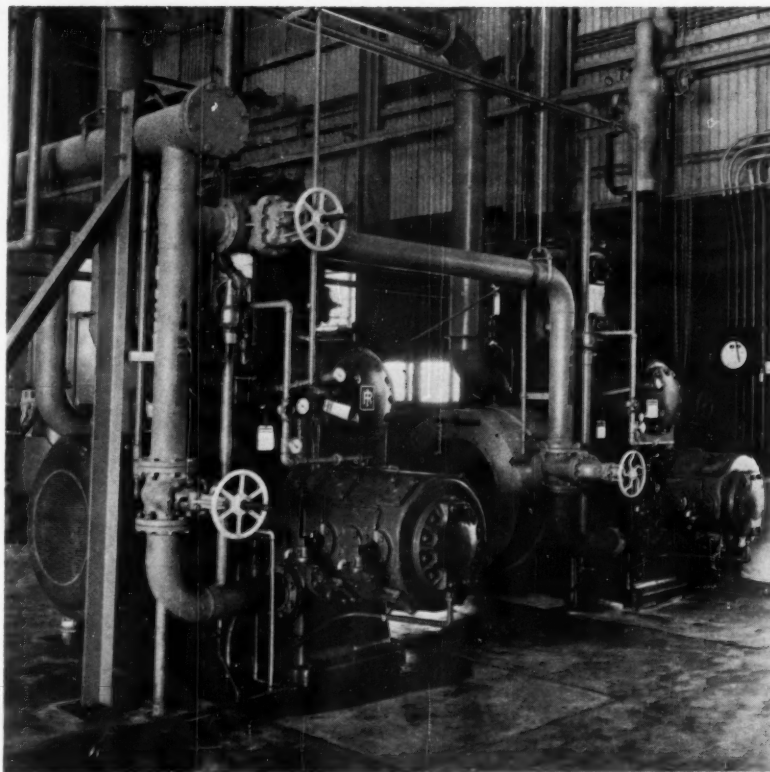
**CARRYING** Many lifting and carrying or shoving jobs are done by compressed air in the new Link-Belt plant. At the top, an air cylinder is shown pushing a basket of parts from a live roller conveyor to an overhead trolley conveyor. A similar task is shown at the left where air cylinders transfer parts baskets to a preselected gravity roller conveyor into storage banks. There are ten of these transfer points and the tote baskets are pin-cooled to actuate the right pusher automatically. In the picture immediately above, air cylinders dip baskets of finish-inspected parts into, first, a fingerprint neutralizer (right), and then into a light rust preventive. Parts baskets from this operation go to the gravity roll conveyor storage transfer points depicted at left.

Compressed air also plays an important part in assembling the bearings. When putting ball bearings together, both rings are match gauged to insure the proper fit of rings and balls. If an outer ring is slightly under size (still, however, being within the strict tolerance) and the inner ring is slightly over size, the races are then equipped with balls on the low end of the tolerance range. Or, if the outer ring is large and the inner one small, the balls on the upper end of the tolerance range are used. For a given bearing, there are ten different sizes of balls in as many hoppers. When the races are match gauged, a signal is sent to the proper hopper and a small air cylinder opens the hopper gate and releases exactly the right number of balls to the bearing assembly jig.

The new plant is largely self-sufficient. A Link-Belt continuous chip-handling and cutting-oil recovery system reclaims better than 95 percent of the cutting oil and also results in a premium quality crushed-chip salvage product. A circulating (closed circuit) grinding coolant system is installed to recover and recondition grinding fluids. A Link-Belt designed and manufactured sewage treatment plant is installed with a daily capacity of 160,000 gallons.

Two 30,000-pound-per-hour coal-fired boilers furnish process steam at 100-psig pressure and heating steam at 30 psig. The city utility furnishes water for domestic use, plant processes and standby fire protection. A 300,000-gallon storage system supplied by a deep well provides fire protection in conjunction with a modern automatic sprinkler system installed throughout the plant.

Electric power for the plant comes from the local utility at 13,200 v and is



**AIR SUPPLY** These two Ingersoll-Rand XLE air compressors supply a total of 2200 cfm at a nominal pressure of 100 psig for the wide variety of tasks performed by compressed air power in the plant. The 200-hp machines are equipped with 5-step clearance control of capacity and are direct-connected to their drivers.

stepped down to 440 v at four load centers within the plant for distribution. Alternators supply frequencies of 120, 240, 420, 660 and 1660 cycles per second for special machines. A pair of compact L-type air compressors, each of

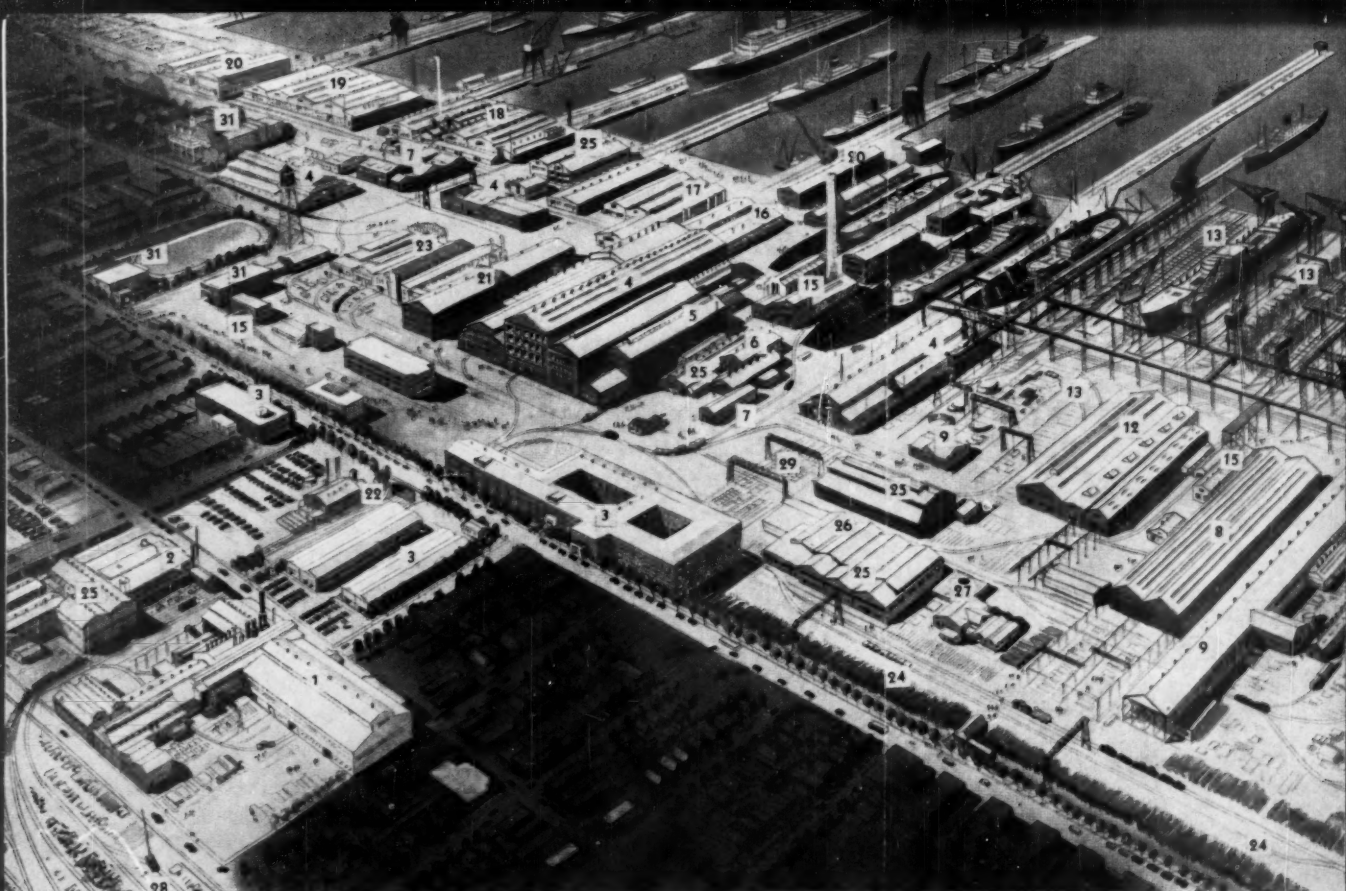
200-hp rating, supply a total of 2200 cfm units have separate intakes and after-coolers. The latter discharge to a common header and receiver installation supplying the main plant distribution net.



**GAUGING** Many of the literally hundreds of gauging operations that must be performed on each bearing are done on air gauges. Besides checking accurately for size, the instruments also determine concentricity and roundness.



**ASSEMBLY** The inner and outer races of ball bearings are match-gauged at the station at the left. When the space for the bearing balls is known exactly, air-cylinder-actuated hoppers overhead discharge the exact number of corrected balls through a tube directly into the bearing. Later (right), retaining rings are put into place.



## LEGEND

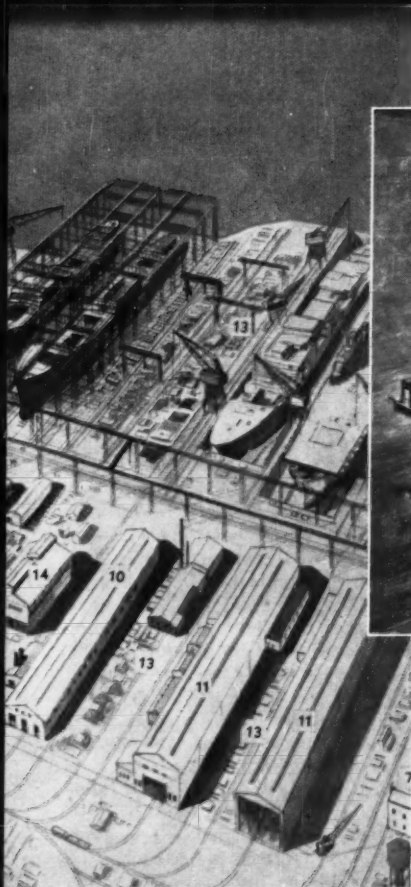
- 1 Foundries
- 2 Pattern Shop
- 3 Administrative and Engineering Offices
- 4 Machine Shops
- 5 Light Forge and Die Shops
- 6 Heavy Forge Shop
- 7 Annealing Ovens and Heat-Treating
- 8 Steel Fabrication Shops
- 9 Hot-Shaping Ovens
- 10 Plate Shops
- 11 Steel Assembly and Fabrication Shops
- 12 Structural Pattern and Layoff Shops
- 13 Assembly Platens
- 14 Galvanizing Plant
- 15 Welding Research and Testing Laboratories
- 16 Paint Department
- 17 Pipe Shops
- 18 Light Metal Fabrication Shops
- 19 Nonferrous Fabrication Shops
- 20 Electrical Shops
- 21 Woodworking, Light Steel and Paint Shops
- 22 Oxygen, Propane and Air Conditioning Plant
- 23 Lumber, Storage and Dry Kilns
- 24 Steel Storage
- 25 Warehouses and Storerooms
- 26 Rivet and Bolt Plants
- 27 Model Making Shop
- 28 Storage Area
- 29 Angle Layout Area
- 30 Welding School
- 31 Apprentice School

## Part I

## The Yard and Its Heritage

1886 was quite a year. Grover Cleveland was president of a financially shaken country, and Victoria had been ruling England for nearly half a century. The first electric street railroad had been operating in Baltimore for 5 months, and Chicago witnessed the Haymarket riots in labor's battle for an 8-hour work day. Geronimo finally surrendered to General George Cook, while on the east coast the Statue of Liberty was unveiled. Sherlock Holmes was born, and so was comedian Ed Wynn. Pope invented his safety bicycle in the U. S.; Daimler, the gasoline engine in Germany. And Collis Potter Huntington was 65 years old.

Chesapeake Dry Dock & Construction



**THE YARD** The drawing right was made in 1892 by Aurelius Ford when Newport News Shipbuilding was only 6 years old. This can be compared with a more recent illustration at left. A point of reference is the wooden stepped-alter-type dry dock which is prominent in the Ford drawing and which is about in the center of the other picture. Ships are launched from the north yard (to the right of the three dry docks) and are outfitted at piers in the south yard. The main office lies along the street in the illustration above; it is Fig. 3 on the waterfront side of the avenue in the other picture. Between the main office and the water lie all types of fabricating shops and laboratories. The main powerhouse is located just to the left of the largest dry dock near the center of the illustration. One substation is near the waterfront behind the apprentice school facilities. Two other substations are located about the same distance to the right of the main powerhouse. A fifth station is installed at the foundry (Fig. 1).

## NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY

S. M. Parkhill

Company was incorporated with a maximum capital stock of \$2,000,000 in 1886—4 years later to be renamed Newport News Shipbuilding & Dry Dock Company. This corporation was to have a profound affect on the development of the American merchant and naval fleets, and consequently the emergence of the United States as a prestige nation in the world community.

The shipyard was a creation of Collis P. Huntington—a man of unique character, founder of the wide-spread Huntington interests. Along with Hopkins, Crocker and Stanford, “the big four,” C. P. Huntington helped to institute the first transcontinental Central Pacific Railway kingdom. He was a tycoon

among his contemporaries who were founding dynasties and great family fortunes. Huntington early stamped the yard with his policy. Since he was so powerful an individual, and since the yard remained in the family for more than a half century, his ships and workers are still fulfilling his dreams and reflecting his nature.

Huntington was purchasing agent for

**BENEFACTOR** Collis Potter Huntington founded Newport News Shipbuilding & Dry Dock Company in 1886. It remained a personal venture until his death in 1900, and was in the family for more than a half century. The attitude of the employees and the ships that are constructed today reflect him.





the construction company of the Central Pacific. He acquired interests in eastern railways and industry while establishing the coast-to-coast system. Among these roads was the Chesapeake & Ohio. It was purchased under an agreement to complete it through the mountains of Virginia and to build a connecting line through West Virginia to traffic centers on the Ohio River. The eastern section was to extend to deep water—eventually, at Huntington's suggestion, the mouth of the James River in Virginia. Although Newport News was then a sleepy village, it possessed access to active deep sea channels and was within easy reach of the hinterland. The extension was opened in 1882, and Huntington's enthusiasm in the industry of the "state of the flowering dogwood" was fully awakened.

The rail terminal of the C & O increased the number of merchant vessels and other ships that came to Hampton Roads, and the town's location was geographically ideal. Yet it was not prospering, due in part to a general business depression. A dry dock—and later a shipyard—where vessels of all types could be repaired would bring employment to many and would make the port more desirable. In the comfortable accuracy of hindsight, Huntington was right; at

the time, he was alone. Those from whom he tried to raise funds did not think a yard would flourish and were afraid because of the sheer boldness of his venture. The shipyard became a personal project and remained such for some time.

**T**HE rectangular site selected by Huntington was owned by Old Dominion Land Company, incidentally also controlled by Huntington as a result of his railroad activities in the East.



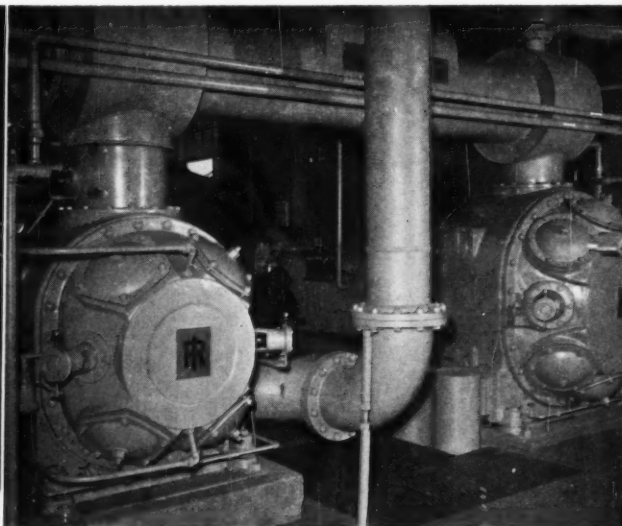
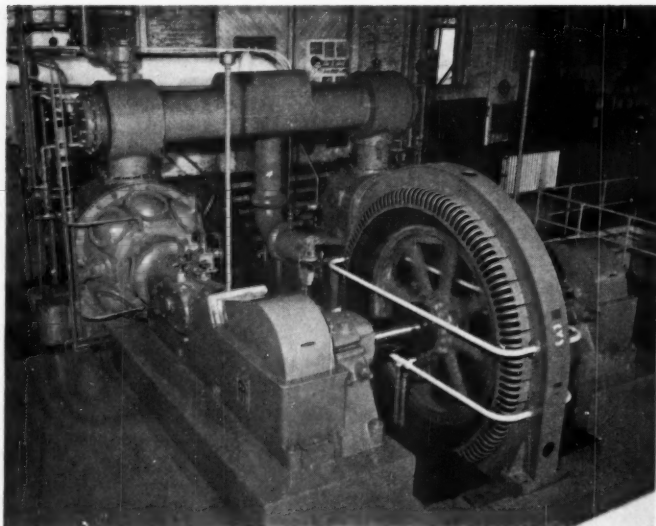
**NEWPORT NEWS** The perspective map above was drawn in 1891 when the population of the county seat of Warwick County, Va., was only 8000. The shipyard can be seen up the James River; the Chesapeake & Ohio Railroad terminal is located further downstream on Hampton Roads. The inset shows a Simpson dry dock.

**GATEWAY TO SEA** Huntington selected Newport News as the terminal for the Chesapeake & Ohio Railroad and the site of his shipyard. Located on the James River, the yard is in one of the most historical sections of America as seen in the names on the map.

It extended 425 feet along the main street, a distance of 2 city blocks. Deep water was readily accessible along the opposite side. The ends of the yard were bounded by space that could be bought for expansion. Land was later acquired in small lots as needed. Today the yard backs along 26 city blocks, has a  $1\frac{1}{4}$ -mile waterfront and covers 240 acres. Spread over the area are 20 miles of standard-gauge railroad tracks and 12 miles of improved road. There are seven shipways, three of the surface type, two semisubmerged and two submerged. In the last mentioned, ships are launched by flooding the way rather than by letting the hull slide into the river, as is the case with the first two.

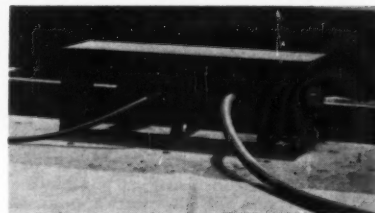
There are also three dry docks of the wooden stepped-altar type—Simpson Docks—one of which was an original structure at the shipyard. These are used principally for repair work. Interestingly, all the shipyards south of Newport News on the Atlantic coast and those on the Gulf of Mexico must depend on floating dry docks or marine railways for repair work. This gives the Newport News yard the advantage of a lower operating and maintenance expense, which is passed on as savings to shipowners who have tied up their vessels for repairs.

The location of the dry docks divides the yard into two sections: the north, which contains the shipways; and the south, which has eight outfitting and repair piers. These range in width from 40 to 80 feet and in length, from 500 to 1043 feet. The aggregate length is 6438 feet—somewhat more than 1.2 miles. Each is built of creosoted wood piling with concrete piling under cranes. Railroad tracks and an asphalt roadway extend the length of many of the piers.



#### TWO ENDS OF AIR SYSTEM

Some of the 50,400 cfm of air used at the yard is furnished by these compressors. The picture above right was taken at Substation No. 4 and shows an Ingersoll-Rand 3400-cfm PRE-2. It has a 24-inch stroke and cylinders of 33 and 30 1/2 inches. It is direct-connected to a Westinghouse 164-rpm synchronous motor rated at 700 hp, 2200 v. The compressor was installed in 1941. The other photograph above shows one of the three compressors in the Main Power House, with a total capacity of 9400 cfm. This one is an I-R 3400-cfm PRE-2 of the same size as the one at the right. It is direct-connected to a General Electric 700-hp, 164-rpm, 60-cycle synchronous motor. The compressors discharge at a nominal 105-psig pressure; an array of lines throughout the yard leads in many cases to protected manifolds, such as the one shown at the right on an assembly platen.



All the cranes that service the piers are of the full-rotating variety; some are of the nontraveling sort, others are of the traveling type. There are also five piers served by locomotive cranes.

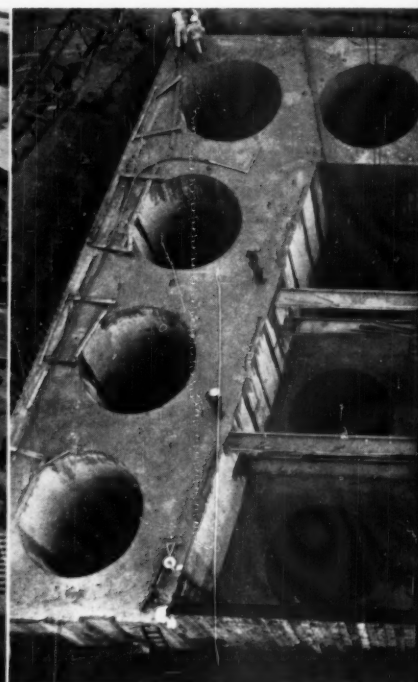
Moving back from the waterfront, a visitor is met by an array of more than 300 buildings. These include all sorts of outfitting shops—sheet metal shops, and electrical and mechanical facilities—as well as canteens and the like. Some buildings are even portable. Many look like industrial plants complete in themselves.

Among the structures are five compressed air powerhouses. They contain a total of fifteen electric-driven compressors with an aggregate capacity of 50,400 cfm. The main Power Plant contains three units with a total capacity of 9400 cfm; Substation No. 1 has six units—21,000 cfm; Substation No. 3, three compressors totaling 10,200 cfm; and Substation No. 4, two units with a combined capacity of 6800 cfm. In addition, the foundry has its own air supply system utilizing a 3000-cfm compressor. Air for each installation is drawn through American Air Filters, compressed, and discharged at a nominal 105 psig.

Running between the compressor installations and the ultimate air manifolds are hundreds of miles of lines. All are underground or are protected by metal shielding. They are of 10-, 8-, 6-, 4-, and 2-inch diameters. Each platen area (where ship subconstruction work is



**CHIPPING ARTIST** Having completed training in the Chippers School, this worker is demonstrating his ability with an Ingersoll-Rand Size C-22 chipping hammer. In this plate beveling operation, the results depend on the operator's experience and reliance in his pneumatic tool. Note the precision with which he holds the tool and the start of the metal spiral. Long spirals beside these men are a common sight.



**PROGRESS** Shipway No. 11 was recently extended making possible the construction of the nuclear-powered aircraft carrier USS "Enterprise." The original shipway is built of cellular sheet piling and was put in during the early part of World War II. A concrete caisson system was used for the addition so nearby buildings would not be undermined and the stability of the older section would be preserved. The job was completed in 264 days by the same contractor that had built the original shipway. The left picture shows the site of Shipway No. 11 before the extension was put in. The next picture shows the caisson taking shape; the right illustration, the extension completed. A 22-foot-wide bridge was put across the end so traffic could flow.

done alongside the shipways) and each pier is equipped with its own sets of lines, along which are grouped valve manifolds. Pneumatic tools can be quickly attached to these when work must be done either on the hull or on component parts. In general, the air lines on the piers are 4-inch diameter.

With such an expansive system it is necessary to have receivers strategically placed along the air lines. These maintain air pressure, and hence, efficiency, and prevent unwelcome pulsations. Thus the pneumatic tools and equipment run at peak power, keeping costs down and producing consistent results in the hands of skilled operators.

For special work in areas not serviced by these lines, as aboard the hulls for outfitting, there are four Ingersoll-Rand portable Gyro-Flo compressors: three of 600-cfm capacity and one rated at 125 cfm.

The first repair dock was opened in

April 1889, the U. S. Navy monitor *Puritan* acting as the test ship. A New York City newspaper heralded the yard as having facilities for repairing the largest vessels afloat. The yard still has this reputation, and recently lengthened its longest submerged shipway to 1100 feet so that it could construct the world's first nuclear-powered aircraft carrier, *Enterprise*, which was launched this month.

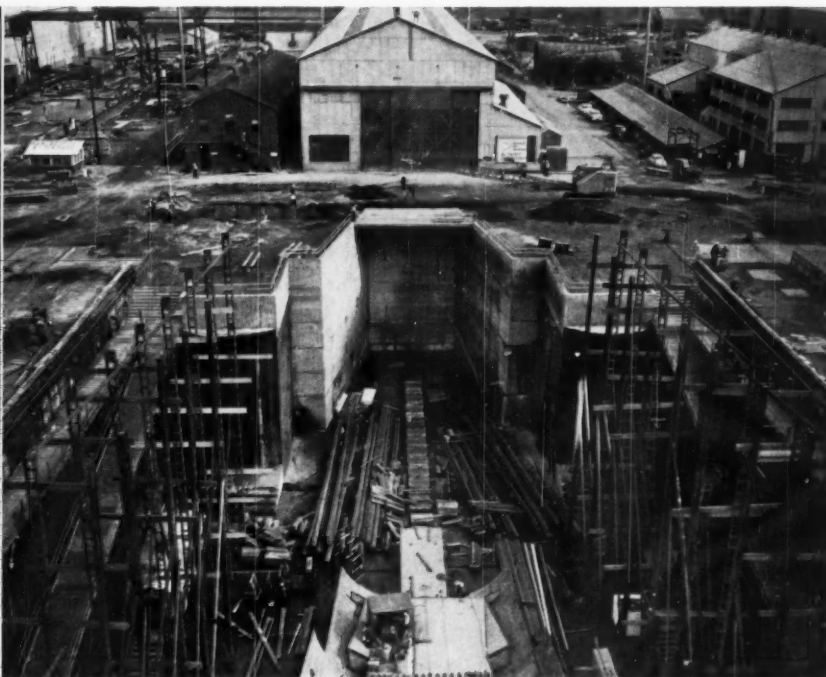
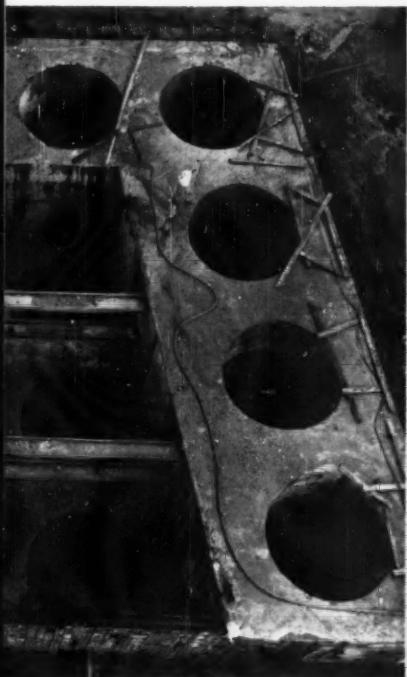
**B**UILDING a shipyard from virgin soil to compete with other major yards of the world is no easy task. As the craft of shipbuilding has evolved, slowly, empirically, so the older shipyards have developed on established foundations. Yet, Newport News Shipbuilding rose quickly in eminence. Numerous unique (at the time) labor-saving devices were installed such as hydraulic traveling cranes, cantilever cranes on trestles for handling material to the ships, and a subway system for steam and utilities pipes. The New York *Herald's* first Sunday edition of March 1901 said of the facility: "... largest shipyard on this hemisphere ... valued at \$13,000,000 ... seven thousand hands at work ... biggest dry dock in the world ... most wonderful revolving derrick in the world, lifting capacity 150 tons, operated by electricity by one man ... greatest collection of electric compressed air power machinery in existence."

The importance of keeping up-to-date is still stressed. Recently added was a Lumotrace system that not only saves

considerable time in hull and subconstruction layout work, but eliminates bulky, wooden pattern storage problems; spectrometer facilities for identifying and measuring pieces of metal; a pneumatic tube system to speed metal samples the 1/2 mile between the foundry and the laboratory; computer systems; motor scooters to hasten deliveries and supplement the yard's own rail and truck lines; and the rebuilding of docks and ways to handle ever-larger ships.

Research and development cannot be overlooked. The progress from sail to steam required 75 years; the change to nuclear power has taken less than 12 years since the splitting of the atom. Newport News Shipbuilding personnel are ready to cope with whatever future developments may become practical in our ever-broadening world of technology—and they are ready to do it quickly to match the momentum science has imposed on our living. The horizon appears confined only by the limitations of our imagination.

**T**RAINING is just as vital in staying ahead of the times as are the physical plant and research. A great deal of time and thought is put into programs at the yard. There are, of course, night classes in such subjects as drafting and blueprint reading, and there are opportunities for the qualified to do graduate work in nearby colleges and universities. Certainly no mention of training can ignore the famous Apprentice School where both academic and vocational education are provided by a highly trained



staff. The courses are equivalent to those of a junior college.

Of equal importance and as well regulated are the specialized schools within the yard proper. One such is the Chippers School in which specially selected men learn the "fine art of chipping." Watching the graduates at work, peeling off long smooth spirals of metal from the plates is proof of the school's quality.

Trainees are taken as the need for chippers arises in the yard. The men must meet specific qualifications not only in general education, but in such physical attributes as strong wrists. A card is made out for each student upon which his progress is charted. Pay increases with advancement, and each man progresses at his own rate. They are on probation for 90 days.

In the initial phase the trainees are taught in a "classroom." Rows of booths equipped with compressed air lines run the length of the school. Each man is assigned his area and is protected from the others by a shield.

The instructors are selected from qualified chippers in the yard who for some reason or another are unable to work on the hulls themselves. They may have a sprained ankle or some other temporary difficulty that prevents them from climbing around the hull structures.

After classroom work, on-the-job training in practical applications begins. The trainees work on jobs about the yard until they qualify for working on the large, and expensive, hull plates. A careful evaluation is made of each man not only with respect to his work and attitude, but to such seemingly unrelated

conditions as claustrophobia or fear of heights. Physical size has much to do with work assignments too. When you look at a hull taking form the men appear as monkeys, swinging in and out, over and around, through and under the structural members. The chippers must keep their minds on their precision work, not on psychological fears.

It is said that it takes at least 2 years to train a man in the craft of chipping; it takes many more before he becomes skilled in the art. However Newport News Shipbuilding can boast of some of the finest precision chippers in the country. Much of their work is done by feel and instinct. Bevel angles and depths, thicknesses of the metal worked on, faulty welds that must be routed and cleaned: all are gauged by judgment, experience, and a reliance on the performance of their pneumatic tools, as will be discussed next month.

**S**HIPBUILDING is unique in manufacturing processes, for each vessel is a single construction, long-term contract. The rules of mass production have little place in a yard. Shipbuilding involves many crafts and skills that can be learned only over a long period. Not only the engineers and technicians, but the men on the ways must have experience in ship design and construction to turn out a good product. When a hull leaves the ways and is moved to outfitting docks, the workers that built this portion of the ship remain behind, waiting for another hull to start. If none is on order, the men must be laid

off. Consequently when they are required again, they may well have found other employment and will not return to their old jobs. Every lay-off, no matter for what duration, means that new men must be hired and money must be spent in training them to work in teams. Therefore, in addition to his skill, every man is urged to learn a secondary trade. Employment is maintained in this way as much as it is by the company's program of product diversification.

The shipyard was faced with its greatest depression in 1922. The yard force was reduced to 2000 men, most of whom were working only part time. To keep its employment steady and its cost down, Newport News Shipbuilding began a program of diversification. Today its products include hydraulic turbines, wind tunnels, large precision valves, heavy industrial equipment of all sorts and paper manufacturing machinery.

Next month, *Compressed Air Magazine* will describe in general terms the complexity of building an ocean-going vessel, will take a look at the role of pneumatic tools in doing the job, and will discuss some of the ships Newport News Shipbuilding & Dry Dock Company has constructed.

(To be continued)





# This and That

## Shoshone's Mysterious Visitors

Countless larvae of the trout's beloved caddis fly mysteriously appear at Shoshone Hydro in Wyoming each winter and equally as strangely disappear each spring. They line the  $2\frac{1}{3}$ -mile diversion tunnel until they hatch and are washed downstream. So numerous are the little cocoon-encased worms that at the height of their incubation period, they slow the waters in the tunnel so much that the plant capacity is frequently reduced by as much as 200 kw. Each winter, when crews enter the tunnel to clear away rock that has fallen from the tunnel ceiling, the silky cocoons form a carpet under their feet—a carpet that extends 11 feet up the sides of the 16-foot-wide tunnel.

★ ★ ★

## A Hot, Gem-Like Flame

Romances sometimes flicker and fail much like the glow of their candle-light settings. The erratic behavior of the candles at least has now been put asunder. A-Try Corporation, Chicago, Ill., makes a device called a Candle Carburetor, a tiny coil of wire that fits around a candle's

wick. The coil controls the air-fuel mixture, which results in a clean, steady flame. Also, candle life is prolonged because the instrument superheats the burning gases. The engineers developing the carburetor met one of the same problems encountered by jet-engine designers. A candle flame burns at about 1200° F, a temperature sufficient to embrittle or soften many metals. Selected was Driver-Harris Company's Inconel X age hardenable nickel-chromium wire. This alloy stands up against the candle heat in the same manner as it takes the fiery blast inside jet engines.

★ ★ ★

## Packaged Nuclear Power

The Martin Company has designed a packaged power producer that derives its energy directly from the heat of decay of pellets of strontium-90. The potentially dangerous isotope is rendered harmless by sealing it in a 3-layer coating of Hastelloy-C, a material so corrosion-resistant that it would provide protection against sea water for centuries. The design envisions about a pound of strontium-90 compound surrounded by a series of thermoelectric elements. This package

would produce about 5 watts of continuous power and could operate without maintenance or refueling for periods of several years. It is designed to withstand plane crashes or even explosions without releasing its radioactive contents. Further, the strontium-90 compound is to be strontium titanate which is virtually insoluble in water. (The biological dangers arising from ingestion of strontium-90 come only when absorbed in soluble form.) The simplicity, reliability and longevity of such a generator, say Martin engineers, would make it ideal for such uses as power supply for channel buoys, unmanned scientific-data-recording stations and other various land and sea devices to aid navigation.

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## "Plan Bulldozer" In Effect

The Associated General Contractors of America has developed a plan for the mobilization of the equipment and trained personnel of the construction industry to ward off disasters, and to alleviate suffering and reduce property damage in the wake of disasters. The program won for the association the Award of Merit from the Chamber of Commerce of the United States. It furnishes simple and effective guidelines in the planning of individual Plan Bulldozer programs on the local level. Thus far, more than 30 AGC chapters throughout the nation have adapted the plan to fit their needs. Six of these were chosen to participate with civil defense authorities in Operation Alert, 1960, which took place in early May. The AGC was cited by the Chamber for "significant contributions in the business and public interest" by enabling the construction industry to mobilize its varied and vital equipment and personnel in a short time.

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## Continuous Vacuum Furnace

A continuous-production vacuum furnace for evacuating and sealing ceramic wafer electron tubes has been designed by the National Bureau of Standards for the Navy Bureau of Aeronautics as part of the Navy's industrial preparedness program. With the system, the tube assembly is introduced into a vacuum and heated to a high temperature. The combination of heat and vacuum degasses the tube and the high temperature brazes together the metallized surfaces of the wafers to make a hermetically sealed unit. The machine was conceived and designed by C. P. Marsden of the Bureau's electron devices laboratory in connection with a study of industrial processes suitable for fabricating electronic components. The furnace does its job with control of only temperature,

## PIPE THIS PIPE!



This alloy-steel elbow is believed to have the heaviest walls ever forged in a pipe fitting this diameter. Made by Tube Turns Division, Chemetron Corporation, the wall thickness is  $4\frac{1}{8}$  inches. The heavy fitting will contain superheated steam at a temperature in excess of 1000° F and at a pressure of 2000 psig. Its internal diameter is  $9\frac{1}{8}$  inches. It will be part of an all-welded power-plant pipe net.

degree of vacuum and time of processing. Up to 200 wafer-tube assemblies per hour have been produced. Essentially the vacuum furnace is a vertical pipe, about 11 feet long, of heat-resisting alloy surrounded by a heating unit and open to the atmosphere at both ends. Through this pipe passes a series of hollow cylindrical specimen carriers, each separated by a short piston fitting closely inside the pipe. Once introduced into the pipe at atmospheric pressure, each carrier is evacuated through holes in the pipe furnace mating with holes in the carriers. The pistons and carriers pass through by gravity feed. In the prototype model, the sliding fit of the pistons maintains the vacuum at 10- to 5-mm Hg and the central portion of the tube can be heated to 1000° C. After processing, the carriers are removed at atmospheric pressure and reduced temperature at the lower end of the tube. Mechanical development and production of the furnace was done by Sanders Associates, Inc.

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#### Safer Welds With CO<sub>2</sub>

The hazard of a serious explosion when repair welding combustible-gas vessels is being removed by a growing industrial technique—carbon dioxide purging. For example, when an 8-foot downcomer pipe at South Works of U. S. Steel Corporation needed the repair of a crack recently, engineers purged the container with 48,000 pounds of carbon dioxide that left an inert atmosphere. The repair was completed safely in about 6 hours. (The downcomer pipe removes blast furnace gas with a 27-percent carbon monoxide content from the furnace for use as combustible gas in other parts of the mill.) The carbon dioxide was introduced into the pipe to displace the flammable gas from the area of the repair. Engineering service and the gas for the job was furnished by Cardox Division, Chemetron Corporation. The supplier points out that CO<sub>2</sub> has many advantages over other materials such as steam, which does not always cause the remaining gas in containers to become inert. In addition, steam may condense and draw air into the system, adding to the danger. There are four specific points, according to Cardox, that make carbon dioxide a superior gas for the service. It is low in cost and easily obtainable anywhere in the United States and in most foreign countries. Further, because it can be handled in bulk quantities, labor is reduced to a minimum. Next, it is relatively heavy, having a molecular weight of 44 compared to 29 for air. This makes it easy to displace air and most common gases from below. Third, its concentration can be easily determined with simple equipment. Other inert gases, such as nitrogen, re-

quire more complex determinations. Last, it is nontoxic and not condensible under use conditions.

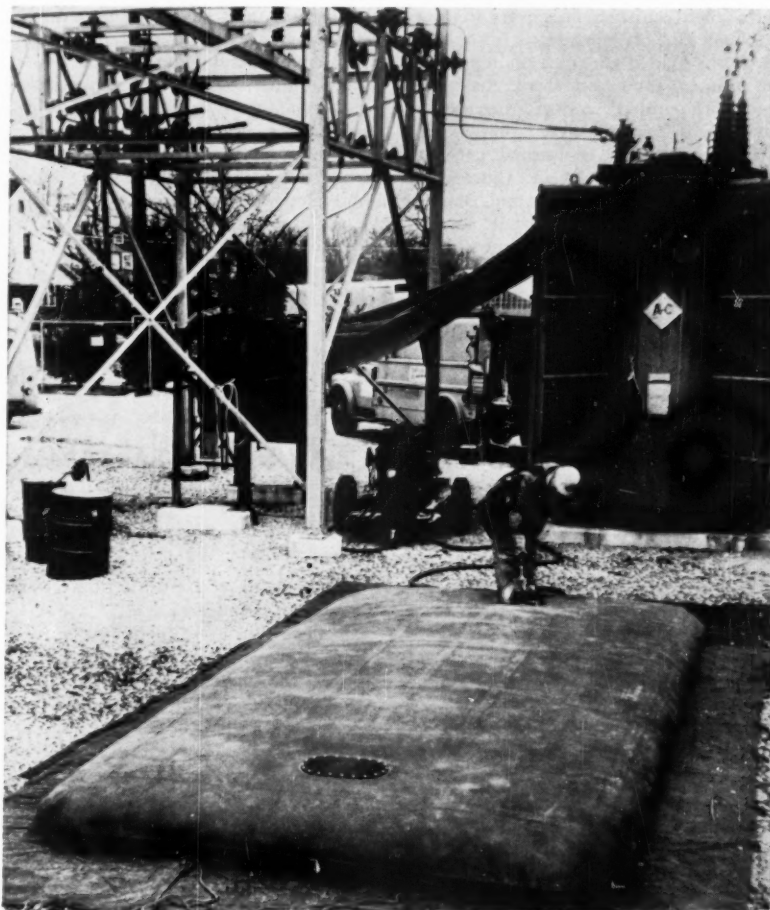
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#### Holding Air Suspensions Stable

The widespread use of air-cushion suspension systems on vehicles has some inherent problems. One of these results from the fact that when the vehicle goes around a curve, the center of gravity tends to be displaced sideward. The load pressure is thus applied heavily on one of the cushions, often until the chassis actually comes to rest on a rubber stop provided for the purpose. To

throttle down the orifice of the passage between the air cushion and the expansion space would be to seriously affect the suspension resiliency under normal driving conditions. The advantages of the system would be largely lost. A Dutch company has developed a tilt-controlled valve in the line between the air cushion and the expansion space that may well be the answer to this problem. When the vehicle is level, the passage is fully opened. When a side tilt is encountered, a mercury switch energizes an electromagnet that actuates the valve throttling down the orifice of the line—thus adjusting the air-cushion system to the new condition. When the vehicle returns to normal level, the mercury con-

## OIL-FILLED PILLOWS



Power companies have found an answer to the problem of drum-juggling or tank haulage involved in the maintenance of oil-filled transformers and circuit breakers. When work on one of these is required, the oil must be removed and stored. Many substations installed at remote points present major problems in just getting tanks or drums to the site. The rubber pillow tank shown here is the solution. Rolled up, it fits in the back of a pick-up truck with room to spare. When not filled with oil, it is light enough to be easily handled. Use of one of these Goodyear-built tanks can cut by two-thirds the time required to drain and refill a big power unit. Some of the largest of this type of electrical equipment have capacities of more than 3500 gallons.

tact is broken and the valve is fully opened again. The mercury switch can be set for quick or delayed action, and the position of the valve is indicated by lights mounted on the dashboard of the vehicle.

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#### Automated Galley Service

The care-and-feeding of continent-hopping jet airplane passengers who expect a full meal while zooming from spot to spot faster than ever before has presented the airlines with some problems in logistics. Engineers for United Air Lines, speaking at the Semi-Annual Meeting and Aviation Conference of The American Society of Mechanical Engineers in Dallas, Tex., told of a packaged galley that can hold all of the best products of 200 cooks and bakers, can be moved from airplane to airplane by any pair of ramp service men, and that puts every item at the finger tips of stewardesses. The galley can be loaded aboard a plane in just 15 minutes—about one-third the time previously required, and of great importance when it is considered that an individual galley may be washed, checked and used at Los Angeles and Chicago in one morning, in New York and Denver that afternoon and at Seattle shortly after sunset. The plastic and metal unit

weighs up to 600 pounds and is 34 × 43 × 60 inches in size. To test the compartment, a full-sized passenger-compartment mock-up was built to see if the stewardess really could "graciously serve the passenger next to the window in 6.23 seconds." The compartments have their own casters and are set aboard aircraft by lift trucks. About 300 such sets will pass through the ten to twelve United Air Lines kitchens and four to five caterers' kitchens each day.

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#### Automobile Exhaust Purifier

A new system for removing smog-producing and poisonous components from automobile exhaust gases has been developed by Union Carbide Corporation. The system combines the advantages of direct combustion with catalytic oxidation to burn between 80 and 90 percent of the hydrocarbons and carbon monoxide in the exhaust stream. It operates at elevated temperatures requiring that it be located quite close to the engine, and uses special catalysts effective at those temperatures. On the other hand, it is small, light in weight and will require no major modification of existing automobile design. The unit is said to meet the requirements of the California Department of Public Health.

quired under the prevailing method of removing the furnishings and sending them to a renovating establishment.

*There have been numerous modern instances of air-powered tools, such as coal picks and rock drills, being illustrated on the postage stamps of various nations. Only one case is known, however, where this was done on bank notes. In 1920, Peru depicted American-made (Ingersoll-Rand) rock drills on two denominations of its paper money. The selection resulted from the fact that drills were important in the mining industry, which was Peru's main source of income.*

Compressed air was used in a British flour mill in 1920 for the novel purpose of killing insects. The victims were Mediterranean moths, which infested some of the wheat imported into the British Isles. If not eradicated, the moths laid eggs that hatched into minute grubs and then developed into more moths.

As the favorite germinating place was in the elevators and chutes of the mill, efforts to eliminate the pests were centered there. Conventional chemicals and fumigants were ruled out because they would contaminate the flour that was being made from the grain.

After several ineffectual trials of other materials, someone noticed that the moths didn't like air currents. A fan was then arranged to blow through one of the chutes and bothered the insects enough to indicate that a stronger blast of air might do the trick. The mill accordingly bought a small Ingersoll-Rand compressor that discharged at 35-40 psig pressure. When the air was introduced intermittently through small holes drilled at various points through the sides of the chutes, it had the desired effect of killing the insects and destroying the grubs. In addition, the grain was cleansed and this seemed to improve the quality of the flour.

*Albert Newman, a 49-year-old farmer in Wales who was blinded during World War II service in Germany, is using his engineering training to advantage. As he drives his tractor he receives through head phones a signal from a radio installation that enables him to plow a straight furrow. Radio transmitting equipment that is set up on each side of the field being plowed was made from spare parts of portable sets. Newman reports that he is now working on a device that will inform him when each of his dairy cows is milked dry. He proposes to operate a warning bell for this purpose with air pressure from a standard-type milking machine.*

## Compressed Air Oddities

*An early projected use of air power was for propelling a helicopter. In 1912, Messrs. Papin and Rouilly described to the French Academie des Sciences what they called a "gyropter." It operated on the principle of Hero's engine, or the ancient aeolipyle. Air escaping from nozzles in the tips of the propeller blades caused them to spin, after the manner of the familiar garden sprinkler. The compressor that supplied the air was driven by a gasoline engine. It was claimed that, if the air failed, the craft would glide slowly to earth.*

A carpet-cleaning device that was outwardly somewhat similar to the familiar modern vacuum cleaner, but which operated in reverse manner, was patented in 1899 by J. S. Thurman, who got the idea while working for the Missouri Pacific Railroad Company at St. Louis,

where passenger car interiors were cleaned with compressed air.

In the Thurman invention, a hose connected to a source of air supply terminated in a metal tube having an 8 × 5-inch box at the working end. As the operator moved the box over the carpet, air was discharged within it in a fan-shaped jet that loosened and removed fine dirt from the surface and carried it into the box. There it was slowed down by passing through tortuous passages and the dust was caught on a screen before the air was discharged to atmosphere.

To a house scheduled to be cleaned, it was planned to deliver air in Mannesmann steel bottles at about 2500-psig pressure. A regulating valve was to reduce the pressure to 50 psig prior to using the air. It was claimed that the carpets and tapestries of a 9-room house could be cleaned, in place, in 2 hours as compared with the 3 to 4 days re-

# EDITORIAL

## Founding

**C**ASTING of metals lies at the very roots of our mechanized age. The importance of founding to the Industrial Revolution is perhaps most graphically illustrated by the fact that many of the nation's—indeed the world's—great manufactories of today grew from small job producers of castings, or merged with such a firm at a very early stage in their growth.

The seemingly simple art of forming a hole in sand and pouring liquid metal into it has been known to man for centuries. Founding remains the most economical way of forming many parts and, indeed, the only way to make quite a few shapes. Furthermore, advances in both major steps (mold-making and metal-compounding) in the casting process have led to end products that can have any of literally hundreds of different properties, or in many cases, combinations of many.

**F**OUNDING cannot be restricted to any one type of metal for almost all of them can be cast without great difficulty. Yet, for practical purposes, founders are divided into those who cast ferrous metals, aluminum, zinc and brass. The ferrous metals lead in tonnage by a vast margin.

According to Department of Commerce figures there are 2876 plants producing ferrous castings in this country. These are broken down into five groups according not only to the end product, but to the type of casting done. Gray iron and ductile iron are made in 2245 plants with an annual productive capacity of 18,000,000 short tons. Malleable iron is produced in 101 plants with an annual output at capacity of 1,250,000 short tons. Three hundred ten steel foundries turn out a maximum of 2,500,000 short tons, and 90 high-alloy and stainless steel foundries have a capacity of 90,000,000 pounds. The fifth category includes 130 investment casters who can turn out 17,000,000 pounds of specialty castings at full capacity.

The total output of all five classifications exceeds \$8 billion in value per year. Total employment, when operating at capacity, exceeds 325,000 persons. Even with last year's lengthy steel strike, deliveries of ferrous castings increased by a factor of from 10 to 20 percent over 1958, depending on the category of product. Government statisticians look for an across-the-board 15 percent increase in 1960 over 1959 tonnage figures.

Output of aluminum castings, too, has been on the upswing with about 835,000 short tons being turned out last year. Comparisons with previous years are not completely accurate because of a change in the method of reporting output. About 18 percent of the total was in sand castings, 36 percent in permanent mold castings and 46 percent in die-cast products. A sizable portion of the forecast 10- to 18-percent 1960 increase in aluminum product shipments may be in castings in view of planned increases in the use of aluminum castings by the automotive industry.

As for zinc and brass or bronze founders, things look almost equally as good. During 1959 about

380,000 short tons of zinc-base alloys were produced and the die-casting industry takes about 98 percent of this in average years. About a 6 to 7 percent increase in such uses is expected for 1960. In 1958 some 59,000 short tons of copper went into the end products of brass and bronze foundries and powder mills, and the year 1959 saw about a 30 percent increase in this figure. Statisticians say 1960 should be about 10 percent better than '59.

**C**OMPRESSED air has been associated with founding operations, especially in the ferrous metals, from the start. Forced draft cupolas were for many years the only means of melting iron for casting. Indeed, most gray iron foundries today still have air-blown cupolas as a source of molten iron although electric furnaces have taken over part of the load. Even so, compressed gases get into the act in the form of oxygen lancing.

For many high quality iron products today, as well as steel castings, vacuum has an important role in degassing the molten metal before it is poured into the molds. The degassing of the metal promotes a more dense casting with less chance of pinholes, voids and certain forms of embrittlement. Sometimes complete melting-pouring-cooling cycles are carried out under vacuum, and the use of controlled atmosphere heat-treating is well-known.

Besides these so-called process uses of compressed air, gases and vacuum, pneumatic power plays an extensive role in foundry operations. Starting right at the beginning of the cycle, pneumatic tools—screwdrivers, Impacttools and wrenches—work in the pattern shops. Air conveyor systems move mold sands from bin to bin for mixing, and deliver the sand to molding stations. Then, on smaller molds, air vibrated tables are used for packing the sand around the mold. On larger molds, hand-held pneumatic-powered sand rammers are used. Throughout most foundries are found air hoists that remain unaffected by the dust and dirt associated with the operations and that provide the heavy muscle to lift castings, and the delicate control for easing heavy sand molds into place.

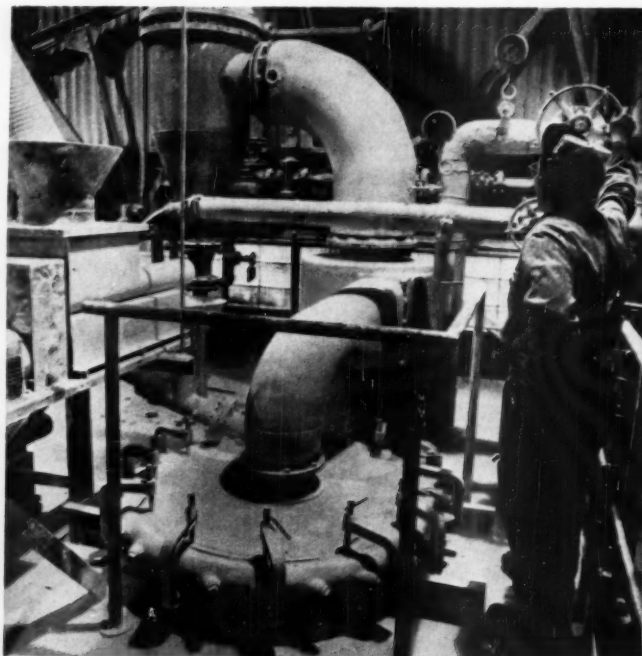
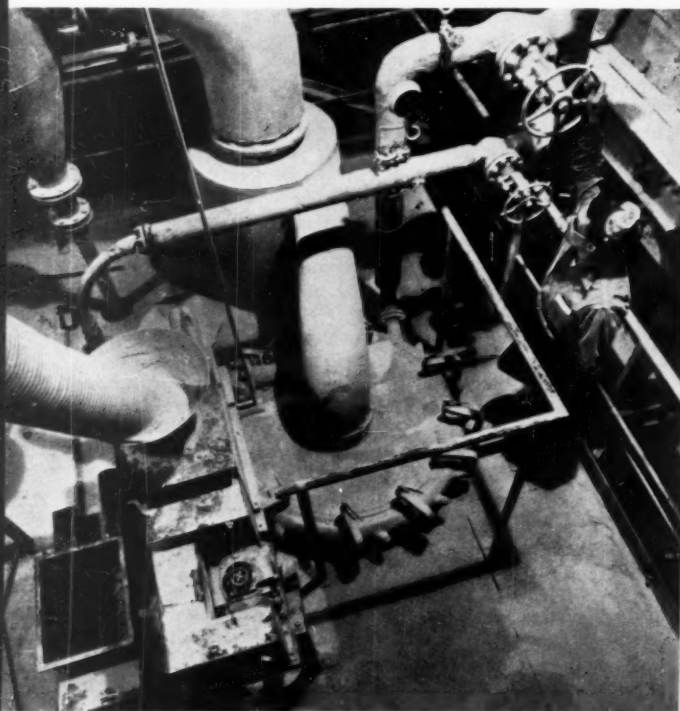
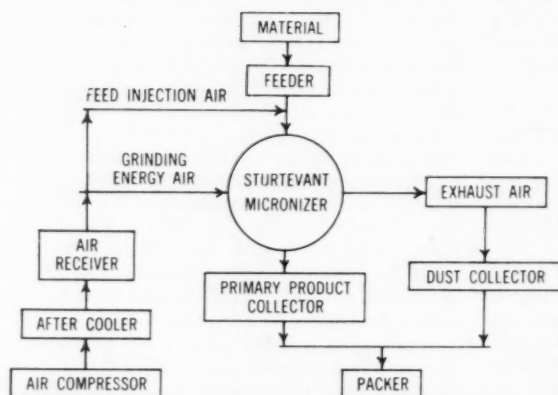
As the sand is removed from castings, air-vibrated shakeout tables are used, special pneumatic tools pull out stuck mold-reinforcing wires and chipping hammers and grinders clean up the castings. Finally, sand blasters take over and air provides the power for final cleaning. Industrial gases also come in for a lot of work in many of these operations being used to cut and remove risers, for repair welding and the like.

**A**CROSS-the-board, in foundry operations, compressed air is vital; in its process uses it might even be called a basic raw material of the trade. As a power source, it's used because it lightens work, saves time and labor, holds down maintenance costs and boosts productivity. In short, compressed air is one of foundings most valuable tools, just as it is for most basic industries.

# FLUID ENERGY GRINDING

Quality enamel is one product possible because of jet-milled titanium dioxide

APPROXIMATELY 55 percent of the total titanium dioxide pigment production serves the paint industry; 45 percent is sold to the paper, rubber, plastics, floor coverings and other industries. These pigments are used extensively because their uniform, small size (the average particle is smaller than a micron) affords ease of dispersability, high gloss and exceptional hiding power: all properties of importance to the paint formulator and the paper coatings manufacturer. When a titanium dioxide supplier can provide ready-to-use quality pigments, users not only are assured of top end-product quality but of, say, an enamel with superior gloss, texture, and optimum brightness. Furthermore, they are relieved of numerous, and costly, grinding steps.



**FIRST OF THE LARGEST** One of two 42-inch Micronizers is shown installed at The New Jersey Zinc Company. In the illustration above, the grinding chamber. The tangential jets are visible between the clamps. The superheated steam outlet is located in the center; titanium dioxide fines are entrapped in the steam and are collected in a secondary cyclone located on the floor below. At the extreme left is a feed venturi. The picture at left was taken looking down on the Micronizer. Again at the left is the feed venturi. Dried titanium dioxide particles enter at that point, are interimpacted in the grinding chamber in the center of the picture. Superheated steam enters near the periphery visible at top right; it is vented through the center of the machine. A typical flow diagram of an installation is shown above, left.

**VENTURI DETAIL** Titanium dioxide enters the Micronizer through this feed venturi. Some superheated steam is diverted to the venturi to hurl the particles into the unit. Tangential jets then take over, forcing the particles one against another until they are crushed to the desired size.

At the moment, the world's two largest Micronizers are shattering titanium dioxide pigments to fractional micron sizes at the New Jersey Zinc Company's Gloucester City, N. J., pigment plant. Working around the clock, these two giant fluid energy mills, together with two other large Micronizers, are fine-grinding titanium dioxide pigments to as small as a quarter micron—one-two hundredth the diameter of a human hair. All of these jet mills were engineered and fabricated by Sturtevant Mill Company, Dorchester, Boston, Mass.

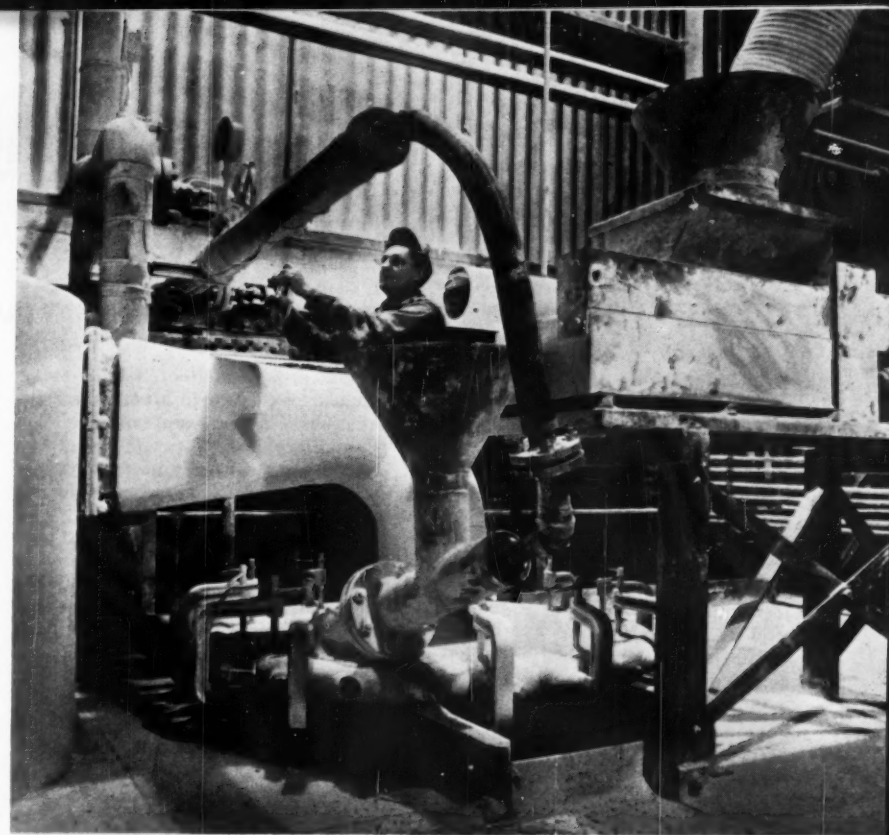
Of the varieties of pigments that constitute the major jet-milled grades, one is an anatase type—A-430—which is used primarily in enamels because of its high gloss and whiteness. It finds uses in plastics, lacquers and exterior paints as well.

Other micronized major sellers are rutile-type pigments. The rutilites include R-730 which is used primarily in industrial finishes, but which also finds a major application in inks, plastics and lacquers. R-760, which offers maximum chalk resistance, is used for exterior enamels, and industrial and automotive finishes. R-750 is another micronized rutile—a multipurpose pigment found in enamels, plastics, latex emulsions and exterior house paints, as well as in industrial and automotive finishes.

Although the individual particle size is of great concern in pigment manufacture, attention must also be given the uniformity of particle size for it too is important. With the Micronizer, uniformity is achieved simply by adjusting the feed rate and/or rate of grinding fluid. These factors control both the rate and violence of interimpaction and ultimately, particle size.

The grinding fluid can be superheated steam, as used by New Jersey Zinc, or compressed air. Compressed air, of course, has the advantage of being able to be furnished dry. Further, air is a much cooler fluid to handle, and is far less expensive than steam.

Prior to the installation of the present battery of jet mills, other types of fluid energy mills were used for production. Although they produced a better, more uniform end product than the ball and hammer mills that served as their predecessors, New Jersey Zinc sought a unit with even better grinding characteristics and greater capacity. The company tentatively decided on the Micronizers, if such could be developed in high-



capacity models. There were already mills with chambers as large as 30 and 36 inches in diameter, so larger ones seemed feasible.

The first Micronizer at Gloucester City was a 30-inch unit, installed about 5 years ago. Its fluid grinding power unit is superheated steam. Later 3-foot-diameter mills were installed. At the time, the 36-inch grinder was the largest Micronizer in existence.

The first 42-inch mill—the world's largest—was installed in 1959 and enabled the company to produce almost as much high-quality pigment as the two 30-inch mills combined. The second 42-inch unit was installed early this year.

Prior to fine grinding by the Micronizers, the titanium dioxide undergoes extensive processing. The ore is first dried, ground and digested in sulphuric acid. After clarification and evaporation, the material is precipitated, filtered, bleached and refiltered. It is then de-

watered, calcined and cooled. Some grades are dry milled and packed immediately. Others receive further treatment—filtering, dewatering, drying, etc. The jet-milled grades then undergo micronizing.

The titanium dioxide is introduced into the grinding chamber through an opening near the periphery. Tangential jets of, in this case, superheated steam cause the violent interimpaction of the particles. Centrifugal force created by the high-speed jets keeps the oversize particles in the grinding zone until they are sufficiently reduced to move inward, coming eventually to the central point of discharge.

Feed rate and the quantity of grinding fluid determine milling energy and production capacity. The 42-inch unit at New Jersey Zinc has a rated capacity of 3 tons per hour, although this varies with the material being ground and the fineness desired.

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*As laboratory experience increases, the Micronizer is finding broader use throughout industry. Micronizers, available in sizes ranging from 2 inches in diameter to the largest—the 42-inch unit at The New Jersey Zinc Company—are most frequently used in the grinding of titanium dioxide and other natural and synthetic pigments, resins, pharmaceuticals and pesticides. (The hand-fed 2-inch mill produces ounces for laboratory analysis work; the 42-inch one can turn out as much as 3 tons per hour.) Beside the materials listed above, the Micronizer is used for grinding aluminum compounds, calcium compounds, carbonates, carbon black, copper compounds, filter materials, fungicides and insecticides, heat-sensitive materials, magnesium compounds, mica waxes and fatty acids, zinc compounds and zircon silicate.*



# Fastening Metal Bands and Buckles

## A SAVING WITH AIR POWER APPLICATION

ONE of industry's most popular methods for clamping two objects together is by use of metal bands and buckles forming pressure clamps, such as manufactured by Band-It Company, Denver, Colo. These pressure clamps are long bands of stainless steel (or pre-formed clamps) that are applied around the objects to be clamped or joined. The bands are pulled tight and the ends locked in full tension in the stainless steel buckles.

The method of applying either type of Band-It clamp is with the Band-It manually operated tool. A band is first placed around the items to be clamped and slipped through a buckle. The band is then threaded through the nose of the tool and through a band gripper behind the tool nose to provide initial tension. Where preformed clamps are used, an adapter is first placed over the nose of the tool. Rotating the tool handle increases the tension and the band is tightened around the object being clamped.

This portable tool may be carried to the job, or mounted in a vise or special bench mount. For production clamp-

ing, an air-powered tool is built to be fastened to a bench in a permanent installation. A pressure-controlled air cylinder on the machine provides adjustable tension to the band. Another air-operated tool is available for removing the clamps.

Recently, the company recognized that under certain conditions it was desirable to have an even faster yet portable method of affixing clamps in quantity. It also needed a portable method that would lessen the fatigue of full-shift production clamping. This could expedite temporary production work to flow past a clamping station. The Band-It Company Research & Development Department found the Ingersoll-Rand air and electric Impacttools work efficiently as a supplemental power source for the tool.

Either the air-powered or electric Impacttool, in effect, is substituted for the manually spun handle of the portable device. A special hexagonal adapter, which fits the Impacttool socket, has been built to connect the Impacttool to the modified manual tool.

The stainless steel band, as shown in the photograph here, is wrapped about

the object to be clamped. The band gripper lever is depressed to automatically hold the band secure. Then an Impacttool is fitted to the adapter and the trigger pressed. In an instant the stainless steel band pulls up tight. The Impacttool is removed, the band cut off with the cutting lever in the tool, the tool threaded with band for the next item to be clamped and the action repeated at a high productive rate.

Although clamps may be applied in a few seconds with the manually operated Band-It device, the Impacttool method helps cut the over-all time of each sustained clamping operation. The impact wrench combines the easy portability of the manual tool with the fast work of a permanent fixture. The Impacttool method is used expressly for those clamping jobs where fatigue of long-run clamping projects hampers the operator; where uniformity with speed is desired; and where occasional sessions of production clamping are required.

**CLAMPING** An Ingersoll-Rand Impacttool tightens a clamp on a rubber hose, using the modified Band-It tightening tool. Both air and electric Impacttools are used.



## Counting Valuable Paper

NOTED at the British Exhibition in New York this summer were two counting machines built by De La Rue Instruments, Limited, London, England.

The 100 Type Checking & Counting Machine uses vacuum to count banknotes, coupons, stock certificates, bonds, etc. Four small upright posts, about 2 inches high, are mounted on a small turntable. As the turntable revolves, the posts, each of which has a suction hole in its side, plucks a single bill from a clip holding many. The number of bills is indicated in a counter window.

The 500 De La Rue Notemaster has a horizontal bar that applies vacuum to count off up to 500 bills in any lot from 1 to 99, at the rate of 10 bills per second. A telephone dial permits selection of the lot number.

Easily operated and needing little maintenance, the instruments provide quick, accurate counting of money and other important papers in large amounts.



# Industrial Notes

**S**HOWN below is a natural gas cutting torch that can slice through 30 inches of metal in a single pass. It has been introduced by Linde Company, Division of Union Carbide Corporation, and is called Oxweld C-66. Reportedly it has the largest gas flow—up to 3000 cfh of oxygen and 250 cfh of natural gas—and the widest cutting range—from sheet metal to large risers—of any existing natural gas hand cutting torch. Yet, operating costs have proved to be 15 percent lower than other natural gas torches because of faster starts and quicker cutting made possible by its large capacity. The torch is capable of handling nearly

every manual cutting job encountered in factories, foundries, steel mills, fabricating shops and scrap yards. (In the photograph it is removing a heavy riser from a manganese steel casting.) Special applications such as gouging, rivet piercing, and pad and fin washing are said to be also handled with ease. Interchangeable injectors make it possible to use the Oxweld C-66 with either low- or medium-pressure natural gas. Spring-loaded injector assembly provides uniform and thorough mixing of gases and eliminates flashback. Additional information is available. *Linde Company, 270 Park Avenue, New York 17, N. Y.*



**S**URF-KOTE A-1290, an air drying solid film lubricant containing molybdenum disulphide, has been developed by Hohman Plating & Manufacturing Company. Conveniently applied by spraying, dipping or brushing, the substance provides a hard and durable solid film lubricant on most types of metal surfaces. It retains a low coefficient of friction over a wide range of pressures, temperatures and surface speeds preventing galling, seizing, fretting corrosion, cold welding and similar friction problems. Used extensively for lubricating surfaces inaccessible after assembly, Surf-Kote is particularly well suited for field applications on heavy machinery and parts too large for high-temperature curing ovens. It has also found wide application as a protective coating, according to company officials. Coated parts may be stored in the open without fear of rust or corrosion from weather conditions. *Hohman Plating & Manufacturing Company, 814 Vermont Avenue, Dayton, Ohio.*

**D**ESIGNED for rugged industrial service, the Size 808 Impacttool illustrated here will handle work to  $\frac{5}{8}$ -inch bolt size. Air operated, it is said to have 20 percent more power and 200 percent faster rundown, even though it is  $2\frac{1}{4}$  inches shorter, than the tool it supersedes. The Size 808 is only  $7\frac{1}{4}$ -inches long, with a side-to-center distance of  $1\frac{1}{2}$  inches and a weight of only  $8\frac{7}{8}$  pounds. It delivers 1100 impacts per minute and has a free speed of 6000 rpm. An air-balanced, rubber-faced throttle valve provides a power assist for smooth trigger pull and easy control. A rubber O-ring in the valve is easily replaced and eliminates need for grinding or lapping the valve seat. Form 5279, describing the new tool and available from Ingersoll-Rand Company, indicates that it has a 2-piece housing construction that permits servicing the impact mechanism without disturbing the air motor. The standard square driver of the tool measures  $\frac{5}{8}$  inch across flats;  $\frac{3}{4}$  and  $1\frac{1}{2}$ -inch square drivers are also avail-

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of Reducing Piping Costs

Let the Victaulic Method save you money on piping costs. Whatever piping material you choose, Victaulic can join it and provide fittings. You save in material cost, in installation time, and in reduced piping maintenance cost.

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For complete information on any Victaulic product, write:

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COMPANY OF AMERICA

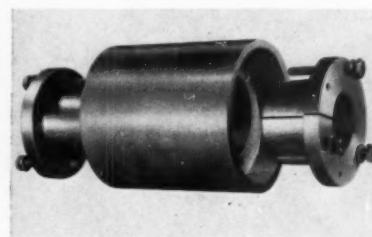
Dept. 64-9, P. O. Box 509, Elizabeth, N. J.

able; 6- and 8- inch extended anvils with  $\frac{5}{8}$ -inch square drivers are offered, as well as quick-change anvils for screw-



driver bits and socket drivers having  $\frac{7}{16}$ - or  $\frac{5}{8}$ -inch hex shanks. *Ingersoll-Rand Company*, 11 Broadway, New York 4, N. Y.

**SURE-GRIP** is a rigid coupling that reportedly will align and firmly connect two shafts. The shafts are clamped by the device's interchangeable tapered bushings. No press or shrink fits are necessary, for the tapered bushings provide the equivalent of a shrink fit when they have been tightened into the sleeve. The precision-machined taper aligns the two shafts automatically as the

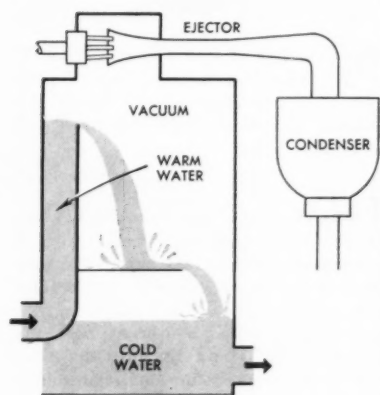


proper torque is applied. Five sizes of No. 44 couplings cover a shaft diameter range of  $\frac{1}{2}$  inch to  $5\frac{7}{16}$  inches. *T. B. Wood's Sons Company*, Chambersburg, Pa.

**SPRAYMIST** is designed to eliminate the usual tangle of tubes, valves and awkward supply tanks associated with mist coolant systems. It is self-contained, having air filter, trap, regulator and gauge, solenoid valve and conduit box, pressurized 5-gallon coolant reservoir and filter. The pressurized reservoir permits mounting in any location without siphon-lift problems: no interruption of flow and no air waste. Coolant and air are separately fed under pressure to the Jet Tip where they are atomized to produce a reported efficient cooling mist without sputter or drip. End-point atomizing prevents condensation in the tube. A needle valve control in the jet

# NEED COLD WATER?

Beat the heat with  
steam-jet cooling!



Simplified schematic diagram of steam jet cooler with surface condenser.

The simplest, most economical way to cool water is to use an Ingersoll-Rand Water-Vapor Refrigeration Unit with a steam-jet cooler. In this system, water is the only refrigerating medium. It *cools itself* by direct evaporation in a high vacuum created by steam-jet ejectors. The small portion of water that is evaporated gives enough cooling effect to chill the remainder.

I-R builds steam-jet coolers in sizes from 30 to 1200 tons and larger, for chilled water temperatures down to 35°F, with steam pressures as low as 2 psig. For more information write today for Bulletin 9143-B.



**Ingersoll-Rand**  
4-998 11 Broadway, New York 4, N. Y.

permits quick, precise mist control with a range of settings from superfine to heavy spray. Stub, rigid extension and flexible jets are available for cutting, sawing, grinding, milling, turning, boring or tapping. The Spraymist units are available in 1-gallon or 18-ounce capacity reservoirs. *Bijur Lubricating Corporation*, 151 W. Passaic Street, Rochelle Park, N. J.

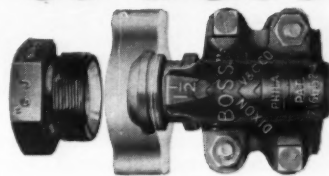
**N**ONSPLIT pneumatic and hydraulic linear-motion ring seals have been introduced by Gits Sealing Device Division. Of special, all-metal construction, the device permits use at temperatures from -425° to 1500° F. Called the Hi-Temp Ring Seal, it was developed to satisfy the increasing demand for high-temperature seals in hydraulic actuators and static seal and swivel joint applications.



Designed as a unit, the seal has a metal lip of special design and configuration, fastened in a stainless steel ring. The ring supports the lip in axial direction and prevents blowout under extreme pressures. (The seals are reported to have been tested under hydraulic pressures in excess of 20,000 psig without showing leakage or other ill effects.) Gits Hi-Temp seals are available in 37 standard sizes, in bore diameters ranging from 1/2 inch to 7 inches. *Gits Bros. Manufacturing Company*, 1866 S. Kilbourn Avenue, Chicago 23, Ill.

**D**-STIX is a new type of visual planning aid that is said to simplify intricate problems for engineers, professional architects, designers and researchers. Designers use the kits for model making and the determination of functionalism and aesthetic efficiency. Architects and engineers employ D-Stix to mock-up a wide variety of structures—girders, towers, trusses, frames, and the like—and to clarify and demonstrate the nature and effect of stresses on various structural members. Chemical and physical researchers use the aids to form molecular structures and to crystallize technical principles. Teachers find D-

## "GJ-BOSS"



GROUND-JOINT FEMALE COUPLING, STYLE X-34

so *Reliable*  
FOR PILE DRIVING

...AND ANY  
STEAM, AIR,  
WATER AND  
HYDRAULIC  
SERVICES...  
HIGH OR LOW  
PRESSURE

*Washerless*



Unequalled for safety, efficiency and long service life. Ground-joint union between stem and spud provides leak-proof, trouble-free seal... no lost or worn-out washers to replace. All parts malleable iron or steel, rustproofed. Furnished with superstrong "Boss" Offset and Interlocking Clamps. Sizes 1/4" to 6", inclusive.

## COMPANION MALE COUPLING

"BOSS"

STYLE MX-16



Companion coupling for "GJ-Boss", described above, and "Boss" Washer Type Couplings Style W-16. Each size fits same size hose... oversize hose not required. Furnished with "Boss" Offset and Interlocking Clamp. Sizes 1/4" to 6", inclusive.

## "BOSS" HOSE MENDER, STYLE BM-16

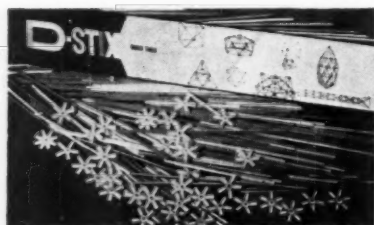


The practical, safe way to restore damaged hose to service. Fitting consists of corrugated mender tube and two "Boss" Interlocking Clamps. Tube has flanges to engage clamp fingers. Thoroughly rustproofed. Sizes 1/2" to 6"

Stocked by Manufacturers and Distributors  
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*Valve & Coupling Co.*

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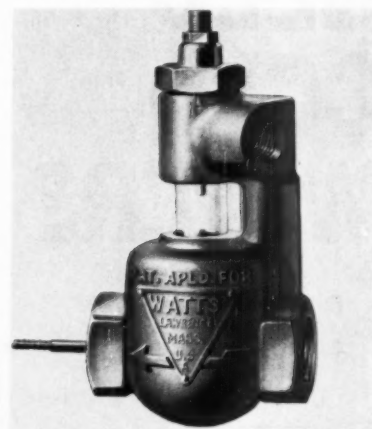


Stix among their most useful aids. Professional kits consist of colored wood sticks and rubber joints, which can be easily combined to form an infinite number of shapes and structures. The sticks slip smoothly into the joints to form rigid, stable units. Both universal and

tee joints, which permit D-Stix to pass completely through, are available. Kits may be purchased at nominal costs in three sizes: 230, 370 and 452 pieces. *Edmund Scientific Company, Barrington, N. J.*

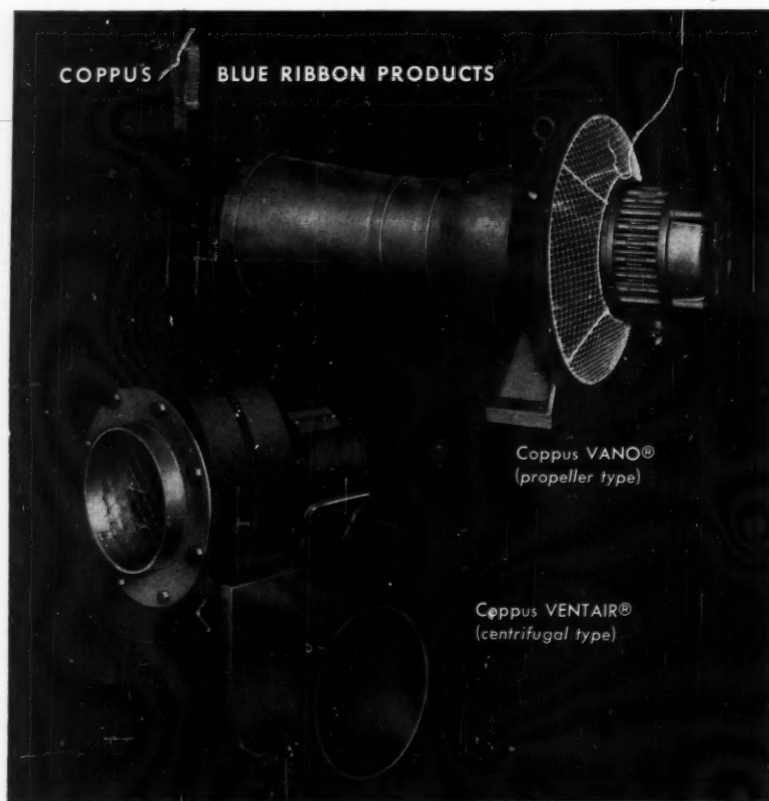
**W**ATTS No. 608 injection oilers are designed specifically for use with low-volume short-stroke air cylinders. They provide proper lubrication previously impossible with ordinary mist-type lubricators, according to a company report. Installed in the pressure line between control valve and cylinder, the injection oiler delivers a controlled amount of oil direct to the cylinder through a capil-

lary tube within the cylinder air supply line. Oil is supplied to the injection oiler either from a standard lubricator



placed ahead of the control valve or from a small oil reservoir under pressure. *Watts Regulator Company, Industrial Division, Embankment Road, Lawrence, Mass.*

**T**WELVE pages and illustrated, *Hose Fittings* gives sizes and specifications of low-pressure, reusable fittings, and one- and two-rayon braid hose. It contains data about union swivel adapters, oxygen and acetylene couplings and connectors, paint spray air hose couplings and connections, male and female hose stems, joiners, adapters, hex pipe nipples, and pipe reducing connectors. Re-



#### GET 30% TO 100% MORE AIR

Coppus Blowers for mine ventilation include the centrifugal VENTAIR for long pipe lines and the propeller-type VANO for shorter lines. For a given power consumption both deliver from 30% to 100% more air than an ordinary fan.

Serving as blowers or exhausters they are driven either by electric motor or compressed air, with capacities up to 60,000 CFM. Like all Coppus Products, these blowers carry the same "Blue Ribbon" assurance of quality and dependable performance.

Representatives located in all mining areas. Other Coppus "Blue

Ribbon" products: Steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also *Thomas' Register*. Coppus Engineering Corporation, Worcester 10, Mass.

**COPPUS ENGINEERING CORP.**  
209 Park Avenue, Worcester 10, Mass.

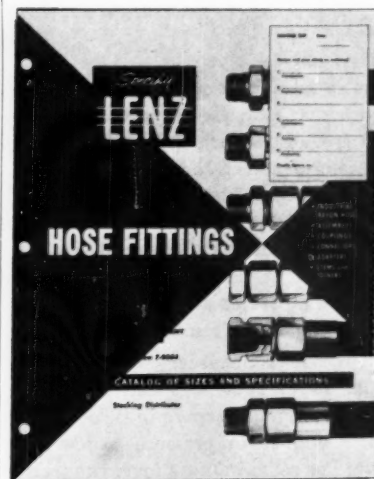
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**COPPUS  
BLOWERS**



quests for the catalog should be made on company letterhead. *The Lenz Company, Dayton 1, Ohio.*

**M**ECHANIPAK seals are the subject of Garlock's Bulletin AD-150. It describes the engineering and application

of the compact, ready-to-install seals. Well illustrated with sectioned and lined drawings, the 8-page brochure outlines temperature, pressure, shaft speed and other critical operating information necessary when selecting or utilizing mechanical sealing devices. Two handy tables are included, one listing standard sizes of Mechanipak seals that are currently available and the other detailing the type of construction of various seals together with the standard and optional features available. Examples of typical applications and several engineering specification forms are included in each bulletin. *Garlock Inc., 446 Main Street, Palmyra, N. Y.*

**F**OR PRECISE control of pressurized fluids, a low-pressure cartridge relief valve installed in a single body or a multivane manifold simplifies circuitry and can be easily removed for servicing without disconnecting lines. This chatter-free direct-operating valve has a re-



ported operating range of 10-500 psig. Specific operating pressures are covered by three pressure ranges. Final adjustment for actual operating pressure requirements within a particular range is made by an external pressure adjusting screw. Further, the valve design permits field pressure adjustment to meet particular operating conditions. Weighing only 6 ounces, the valve is built of stainless steel and anodized aluminum and will handle all fluids compatible with material used in construction. *Fluid Regulators Corporation, 313 Gillette Street, Painesville, Ohio.*

**P**PIPELINE strainers for condensate, steam, water, oil, air, gas, and other piped fluids are detailed in Sarco Bulletin No. 1210. This 4-page brochure discusses construction and operating features of a range of Y-type strainers designed to protect steam traps, pumps, control valves, compressors and similar equipment against dirt, scale or metal chips in the line. *Sarco Company, Inc., 635 Madison Avenue, New York 22, N. Y.*

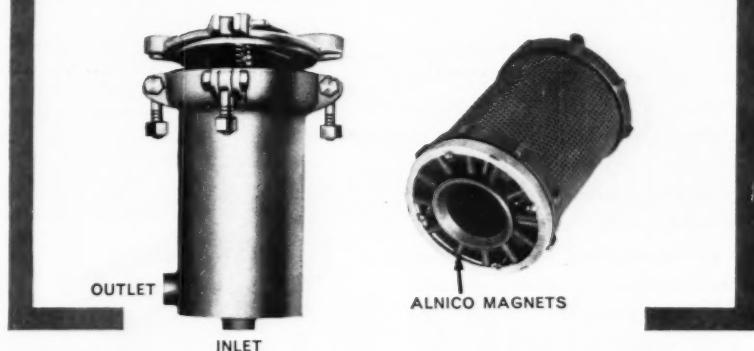
**H**HEAT-LES dynamic desiccant dryers—their technical specifications and capacities—are discussed in bulletin HA-308.

In addition to standard model listings, the brochure contains complete formulae and tables for sizing this type of dryer. The Heat-Les units do not require heaters for reactivation of the desiccant beds, provide dewpoints below  $-100^{\circ}$  F for compressed gas or air, and are available in a large range of capacities to meet industrial, scientific and military needs. *Trinity Equipment Corporation, Cortland, N. Y.*

**S**ELF-STORING air hose with a  $\frac{3}{8}$ -inch inner diameter, called the S12 Synflex, was designed to meet the demand for a retractable air hose of greater capacity than the original  $\frac{1}{4}$ -inch Synflex.

It extends and retracts like a telephone extension cord. With a total hose length of 25 feet, it has an extended working length of 20 feet and retracts into a compact space-saving coil of only 9-inch length and 5-inch outer diameter. It eliminates hose reels and other cumbersome storage equipment when used with portable pneumatic blow guns, nut setters, chippers, snagging tools, disk sanders, belt sanders, jitter bugs, impact wrenches, air hoists and the like. According to the manufacturer, the advantages of the S12 Synflex include lighter weight which reduces operator fatigue and resistance to kinking. It is supplied with reusable couplings that are easily assembled, and a spring guard to

### GET THE ADDED PROTECTION OF MAGNETIC SEPARATION WITH THIS BASKET-TYPE STRAINER



Nugent now manufactures a line of basket-type strainers offering the added protection of magnetic separation. Specially designed Alnico magnets establish a magnetic field through which the strained liquid must pass as a final stage before leaving the unit. Thus, minute ferrous particles are trapped and removed from the fluid stream.

If you have valuable engines or other equipment which demands top-notch lubrication protection, it will pay you to get the full story on the Nugent combination strainer-magnetic separator.

Write today . . . no obligation, of course.



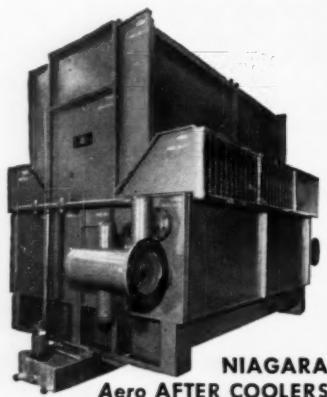
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● Cooling gases or cooling and removing moisture from compressed air, the Niagara Aero After Cooler offers the most economical and trustworthy method. Cooling by evaporation in a closed system, it brings the gas or compressed air to a point close to the ambient temperature, effectively preventing further condensation of moisture in the air lines. It is a self-contained system, independent of any large cooling water supply, solving the problems of water supply and disposal.

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Niagara Aero After Cooler systems have proven most successful in large plant power and process installations and in air and gas liquefaction applications.

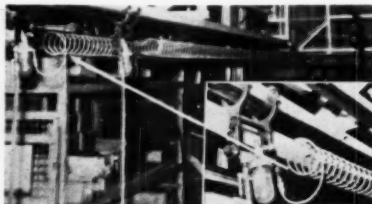
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## NIAGARA BLOWER COMPANY

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*District Engineers in  
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prevent crimping. Made from a nylon formulation, the hose is impervious to



oils; its micro-finished bore and full-flow nonflared couplings assure unobstructed air flow pressures to 200 psig. Samuel Moore & Company, Synflex Products Division, Mantua, Ohio.

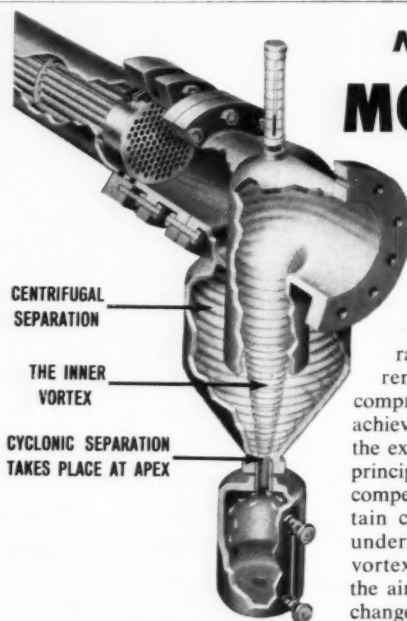
## Books . . .

*How to Chart Data* (published by McGraw-Hill, 327 W. Forty-First Street, New York 36, N. Y.) was written by Phil Carroll. It provides guidance on charting as a tool of better management in areas of work measurement, plant scheduling, and control of costs. It explains types of data required for various problems, and shows ways of presenting them in easy-to-analyze form. Methods for using charts to solve problems involving multivariables are a special feature. Six different chart forms are dealt with. Their development is shown in

progressive illustrations, and the general conditions for their use are pointed out. Included are means of using charts to reach solutions of problems generally believed to be possible only through the use of operations research and computers. The author is well qualified to write such a book as this, for he is a practicing industrial engineer, a consultant and a popular speaker before industrial management groups. 250 pages. Cost, \$7.50.

## Films . . .

*This Is Automation*, a 16-mm sound-and-color motion picture, documents a practical, step-by-step plan for achieving automation, and defines the subject in terms of benefits to be obtained through automation. In "how-to" language, supported by actual machines and processes, the film shows how planned steps can increase productivity, up-grade worker skills, improve quality, expand capacity and cut costs. The film is presented by General Electric Company and was produced by Raphael G. Wolff Studios, Inc. It is available on a free-loan basis from Association Film's distribution centers at the following addresses: Broad at Elm Street, Ridgefield, N. J.; 561 Hillgrove Avenue, La Grange, Ill.; 799 Stevenson Street, San Francisco, Calif.; and 1108 Jackson Street, Dallas, Tex.



## NEED BETTER MOISTURE AND OIL REMOVAL?

(for your compressed air system)

Only the Adams CYCLONE Separator assures peak efficiency in the removal of oil and water from your compressed air system. Top operation is achieved from one-quarter to full load by the exclusive cyclone design. It is a proven principle of operation which automatically compensates for variation in load to maintain constant separating efficiency. The underlying feature is the inner cyclonic vortex formed within the unit itself by the air stream. The diameter of the vortex changes in proportion to variations in the load or air velocity. However, the angular air velocity, the RPMs, remain constant — and it is the angular velocity — the infinite changes of direction, which effect the separation of entrained particles at practically constant efficiency.

Remember, your aftercooler is only as effective as the separator which removes the condensed oil and water. Find out today how the Adams design can improve your oil and moisture removal efficiency. Write today for your copy of Bulletin 714.

**R. P. ADAMS CO., INC.** 209 EAST PARK DRIVE  
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## **NEW CRAWLMASTER DRILL**

**packs more weight, power and versatility**

**than any other machine in its class**

AT A LARGE Southern Granite Quarry, this Gyro-Flo powered Crawlmaster demonstrated its super-slugging power by out-drilling two larger-bore machines in competitive performance tests. With its new super-power D-525 Drill and constant-pressure hydraulic feed and retraction, the Crawlmaster rated highest in both average and maximum penetration in all tests. Capable of percussion, rotary or Downhole drilling of 4" to 6½" holes in any position from vertical to horizontal, this 11-ton machine with dozer-type crawlers has the weight and stamina to handle the toughest drilling jobs. Features include all-hydraulic tower positioning, four 30" stroke leveling jacks, remote-controlled reverse rotation and simple ejector-type dust collector.

An Ingersoll-Rand 900-cfm Gyro-Flo rotary compressor provides ample power for all drilling and moving functions. With other interchangeable drill combinations,

a 600-cfm unit is ample. But whatever the size, Gyro-Flo's traditional dependability, smoothness of operation and exceptional freedom from maintenance make it the ideal Crawlmaster power supply. Low oil consumption, air temperatures under 200°F and closer regulation all the way from no load to full load contribute to lowest possible air power costs.

Ask your I-R distributor or engineer for complete information on the cost-cutting Crawlmaster Gyro-Flo combination.

**Ingersoll-Rand**

66A14

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*A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK.*

Great names—that made  
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$$\frac{V_1}{V_2} = \frac{P_2}{P_1}$$

"If the temperature remains constant, the volume of a gas is inversely proportional to the pressure."

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Liquid and gas filtration has been the specialty of Air-Maze for the last 35 years. Yet Boyle's 270 year old discoveries relating to the compression and expansion of air and other gases must be recognized and taken into consideration by our engineers in designing new equipment to keep modern machinery operating efficiently.

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The representative products shown below were designed and developed by Air-Maze engineers to solve highly specialized filtration problems. If your product involves any gas or liquid that moves, Air-Maze engineers can help you.



Typical of many breather-filters available for every vent and crankcase.

Vane type exhaust spark arrester. Meets U.S. Forestry Service Specifications.

#### OTHER AIR-MAZE PRODUCTS:

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Breather Filters • Oil Mist Eliminators

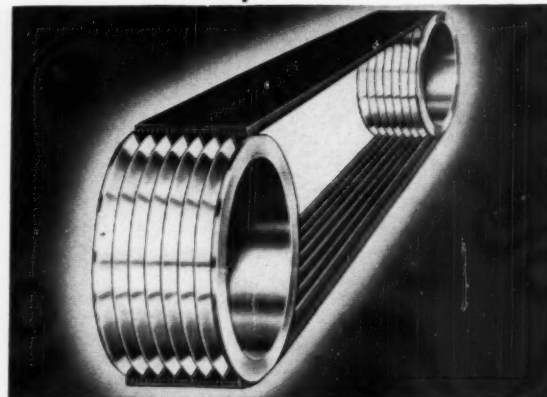


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- MAINTAINS GROOVE SHAPE
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- COMPLETE CONTACT-PRESSURE
- TWO BELT CROSS SECTIONS MEET EVERY HEAVY DUTY POWER REQUIREMENT

Poly-V is patented Write For Bulletin M141

RM1013

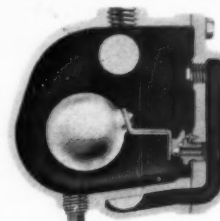
Engineered Rubber Products .. More Use per Dollar

**RAYBESTOS-MANHATTAN, INC.**

MANHATTAN RUBBER DIVISION, PASSAIC, NEW JERSEY

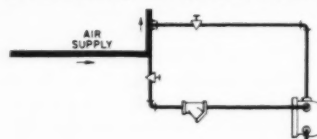


get MORE WORK  
from your  
CA tools



Cross-section of Type FA Drain Trap showing float design that keeps condensate level above trap, providing seal against air leakage.

## INSTALL SARCO FA DRAIN TRAPS



Typical Hook-up

Get more useful work from your compressed air tools. Sarcos Automatic Drain Traps keep condensate level in trap body above the valve. That maintains a positive seal against air leakage and gives you a steady supply of dry air. Dry air saves maintenance, too, and prevents damage to tools from impaired lubrication and waterhammer. It avoids slowed-down production resulting from freezing in tool exhaust.

Write for Sarcos Bulletin 520, full of ideas to help increase effectiveness of your present air compressor capacity. 2917

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**Complete Line**  
OF H.P. RATED  
**AIR COMPRESSOR  
SWITCHES**

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- ② Standard Duty
- ③ Gas Engine Cut-Out
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and pressure ratings

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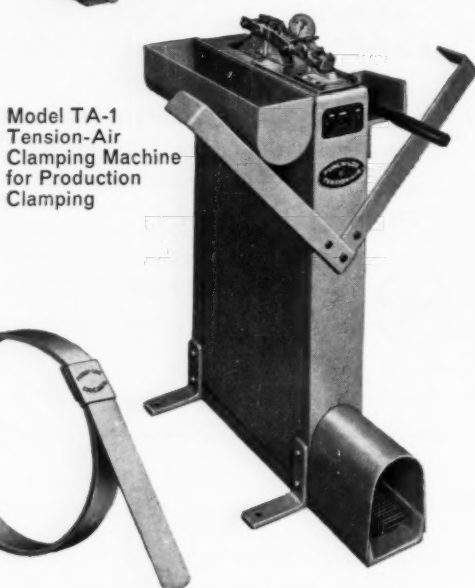
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Model P-38  
Loking Tool



Model P-1  
Loking Tool



Model TA-1  
Tension-Air  
Clamping Machine  
for Production  
Clamping



## A Complete Line for Your Hose Clamping Requirements

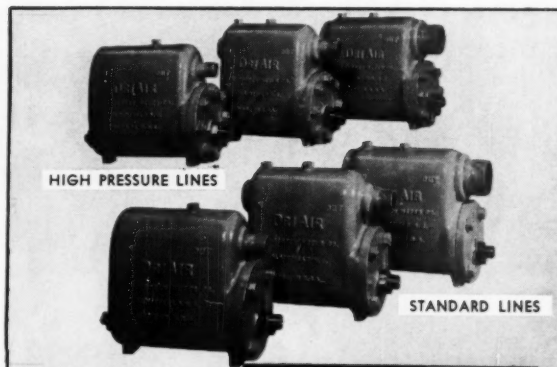
There is a PUNCH-LOK Hose Clamp and clamping tool for every need. All PUNCH-LOK clamping tools are dependable, easy to operate, and apply to any size PUNCH-LOK Clamp. Simple, manually operated types will handle general hose maintenance requirements—the Tension-Air Machine provides high-speed, long-run clamping production.



See your nearby Punch-Lok distributor, or write direct.

**PUNCH-LOK**  
*Company*

Dept. H, 321 North Justine Street, Chicago 7, Illinois



HIGH PRESSURE LINES

STANDARD LINES

## COMPLETE PROTECTION FOR YOUR EQUIPMENT with

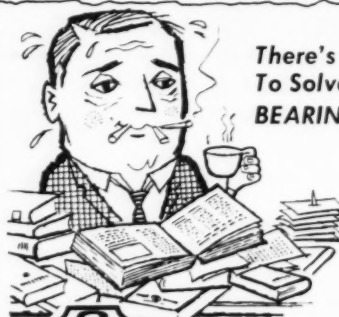
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All New Jersey Meter DriAir Units are complete and self contained. DriAir Separators are the answer to many problems which arise in various applications of compressed air. They speed production by separating and automatically ejecting the condensed water and oil from the air. They reduce wear and prolong the life of tools by collecting dirt and rust and by promoting good lubrication. DriAir units are entirely automatic and require no separate traps or other accessories.

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Standard Units for 150 lb. lines  
3/4" - 1" - 2" Units from 50 to 300 CFM

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BEARING PROBLEMS...



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**BEARIUM METAL**  
Your Best Buy in Bearing Bronze



**FEATURES:** Non Seizing and Non Scoring • Long wearing • Self Lubricating • Low coefficient of Friction • High Compressive Strength • Resistant to Shock loads • Sound, Uniform Structure.

Literature on Request

Your search for the ultimate bearing material ends with BEARIUM METAL. It is the one material that stands up to every adverse operating condition—high speed, poor lubrication, elevated temperature, dust, dirt, gritty surroundings and lubrication with liquids other than oil. Because the microscopic lead particles are uniformly distributed within the copper-tin grains (compared with the haphazard distribution of lead between grains in ordinary bronze), BEARIUM METAL will not score or seize the shaft, nor will it melt out like babbit. It is because of its superior frictional characteristics and amazing reliability that BEARIUM METAL can be depended upon to out-perform any other bearing material.

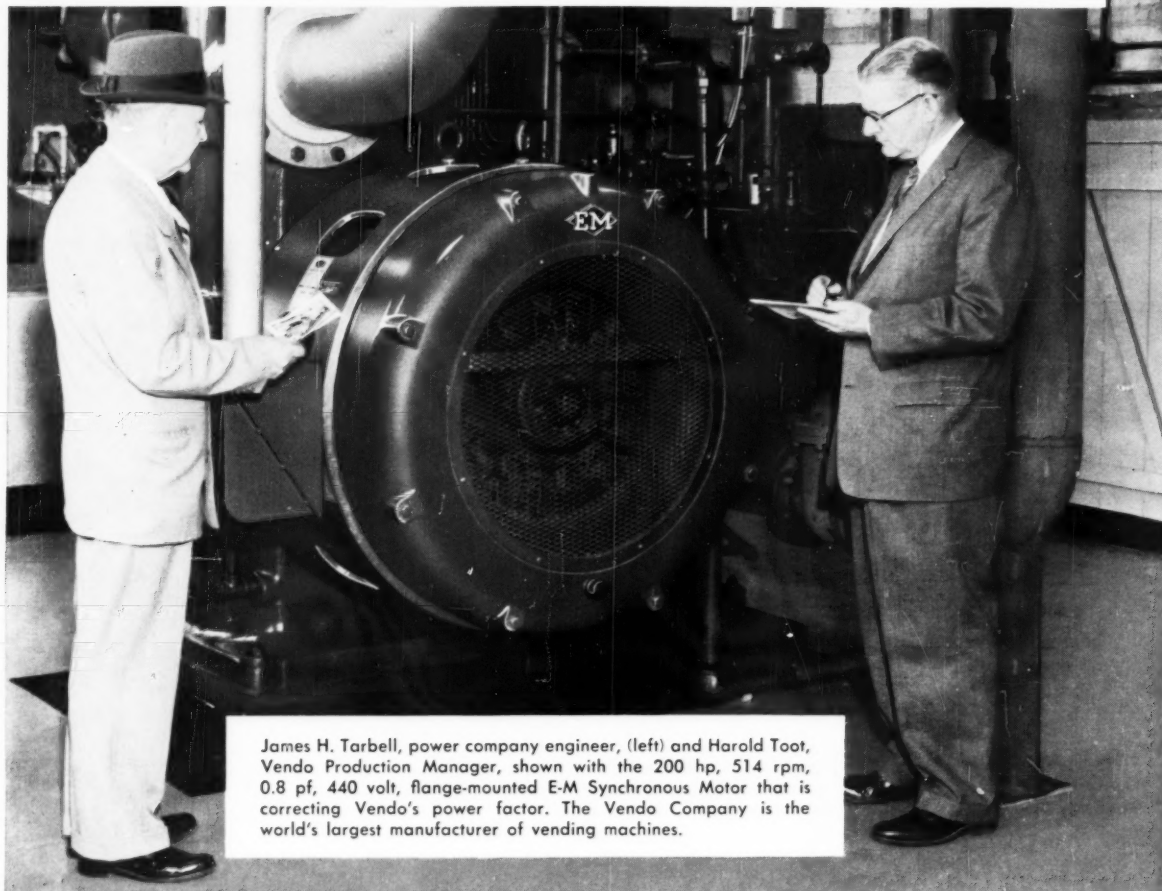
Available in solid or cored bars, centerless-ground rods, machined parts and pattern castings. Literature on Request.

**BEARIUM METALS CORP.**

190 MILL STREET • ROCHESTER 14, N. Y.

WEST COAST: CANADA:  
NEVIN ENGINEERING ASSOCIATES BEARIUM METALS OF CANADA, LTD.  
Pacific Palisades, California Richmond Hill, Ontario

## Are You Paying Big Penalties for Lagging Power Factor?



James H. Tarbell, power company engineer, (left) and Harold Toot, Vendo Production Manager, shown with the 200 hp, 514 rpm, 0.8 pf, 440 volt, flange-mounted E-M Synchronous Motor that is correcting Vendo's power factor. The Vendo Company is the world's largest manufacturer of vending machines.

## Vendo Company Corrects Power Factor... SAVES \$450 A YEAR! with an E-M Synchronous Motor

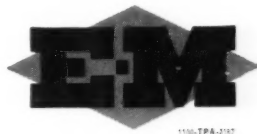
The Vendo Company, Kansas City, Missouri learned its plant was operating at a lagging power factor condition when expanded production facilities required more compressed air. A study by Vendo's engineers and Kansas City Power & Light Company showed an 0.8 leading power factor synchronous motor compressor drive would save them money. Here's how:

Vendo's power contract provides a penalty of 20 cents a month for every reactive kva exceeding one-half the maximum kilowatt demand. *This was costing Vendo \$33.00 per month, or \$396.00 a year!*

A 20 cents a month bonus is granted for every kilovar the reactive demand falls short of one-half the maximum kilowatt consumption. A 200 hp E-M Synchronous Motor with 0.8 pf would provide enough reactive kva for Vendo to operate at a *leading* power factor and earn a monthly credit of \$4.60. Vendo's power bill would then be reduced by \$37.60 a month, or \$451.20 a year!

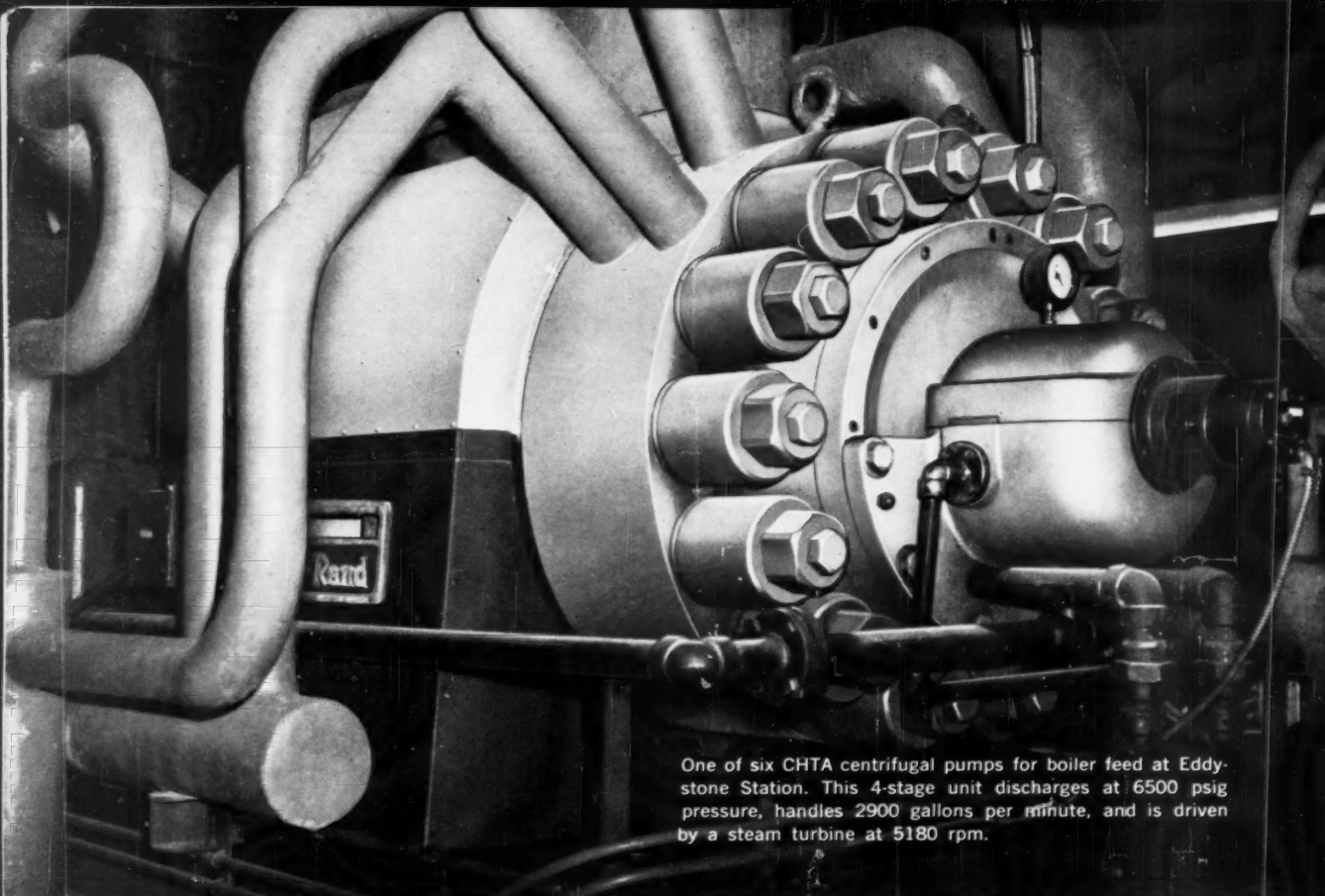
Vendo installed the recommended E-M Synchronous Motor... and has been enjoying a reduced power bill ever since. You, too, can make a big saving in your plant power bill by correcting your power factor with highly efficient E-M Synchronous Motors.

Learn more about Power Factor. Call your nearby E-M Sales Engineer and write for your free copy of the new E-M 24-page brochure, *The ABC of Power Factor*.



**ELECTRIC MACHINERY MFG. COMPANY**  
MINNEAPOLIS 13, MINNESOTA

*Specialists in making motors do*  
**EXACTLY WHAT YOU WANT THEM TO**



One of six CHTA centrifugal pumps for boiler feed at Eddystone Station. This 4-stage unit discharges at 6500 psig pressure, handles 2900 gallons per minute, and is driven by a steam turbine at 5180 rpm.

## World's highest-pressure boiler feeders now on the line at Eddystone

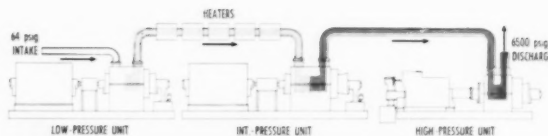
*Six Ingersoll-Rand centrifugal pumps boost boiler feedwater from 64 to 6500 psig at "world's most efficient power plant"*

Specifications for the 325,000-kw Unit No. 1 of Philadelphia Electric Co.'s Eddystone Station exceed those of any other power station ever built. Steam pressure is 5000 psi, steam temperature reaches 1200°F ultimately.

The Ingersoll-Rand centrifugal pumps handling the feedwater, which reaches a temperature of 574°F, are the highest-pressure boiler feeders ever built. Discharge is 6500 psig. There are two half-capacity systems, each consisting of low-pressure, intermediate-pressure and high-pressure pumps.

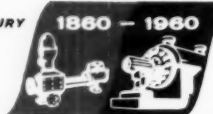
All of the I-R pumps are Class CHTA—single-suction, multi-stage diffusor-type units featuring symmetrical "double-case" construction and "unit-type" rotor assembly for dependable performance and minimum maintenance. The shaft, impellers and stationary channel rings are assembled as a compact, completely self-contained inner-casing unit.

For more information on the CHTA, contact your I-R representative. Or write for bulletin 7211-A.



Six I-R CHTA pumps are operating at Eddystone in two half-capacity systems, each consisting of three pumps in series as shown above.

A CENTURY 1860 - 1960 OF PUMP PROGRESS



**Ingersoll-Rand**

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